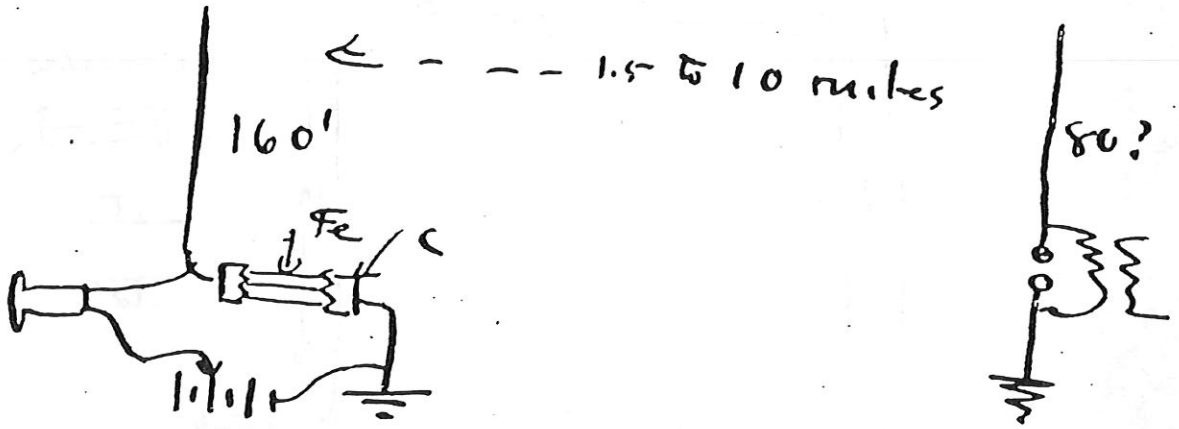
Pickard Exhibit

ORIGINAL NOTES

May 29, 1902 *to August* 28, 1906

May 29/02

Carbon-Steel Detector.



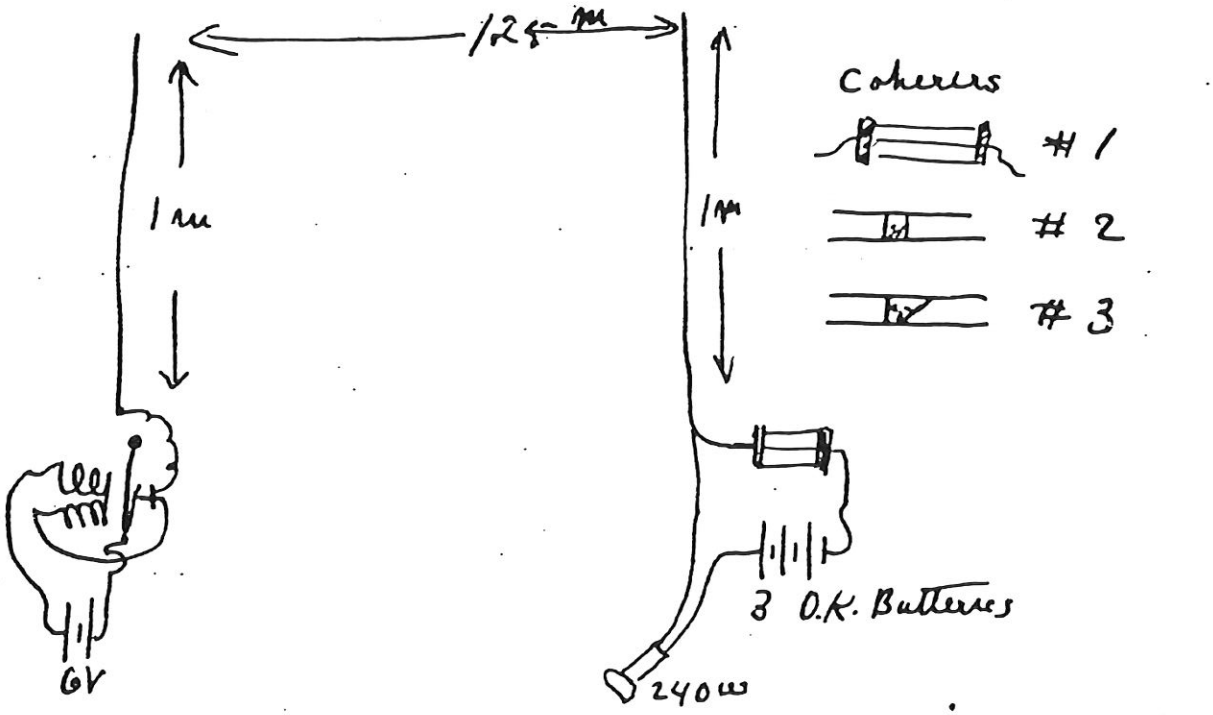
C. May station.

Good signals with batteries = 3 v. cutting out battery entirely, faint signals could be heard, even at 10 m. Were loud enough to read.

July 17th 1902-

arbon coherers with Telephone Receiver.

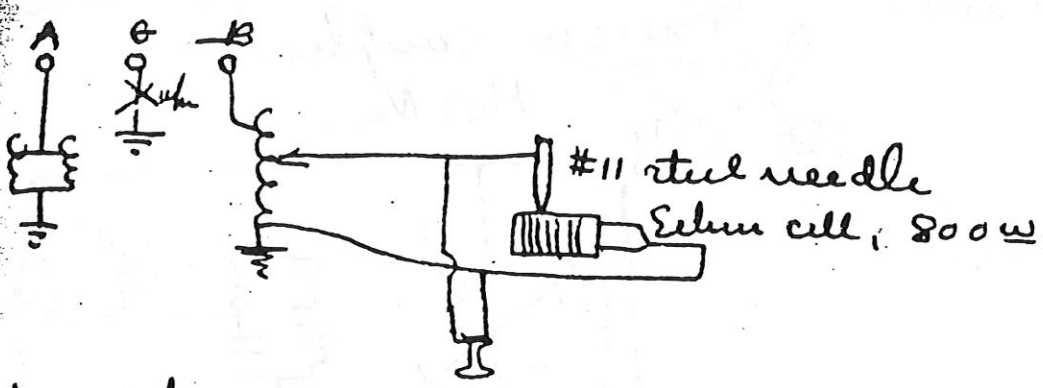
Tried various samples of granular carbon between Ni
ings for a carbon coherer. None gave results
ival to the steel-needles-on-carbon-discs coherer



y little difference between the various samples of
nular carbon. The resistances seemed to depend
re on the amount of carbon between the electrode
the pressure upon it, than on the quality of
e.

South Boston
Sept 26/05

...ion Coil detector.

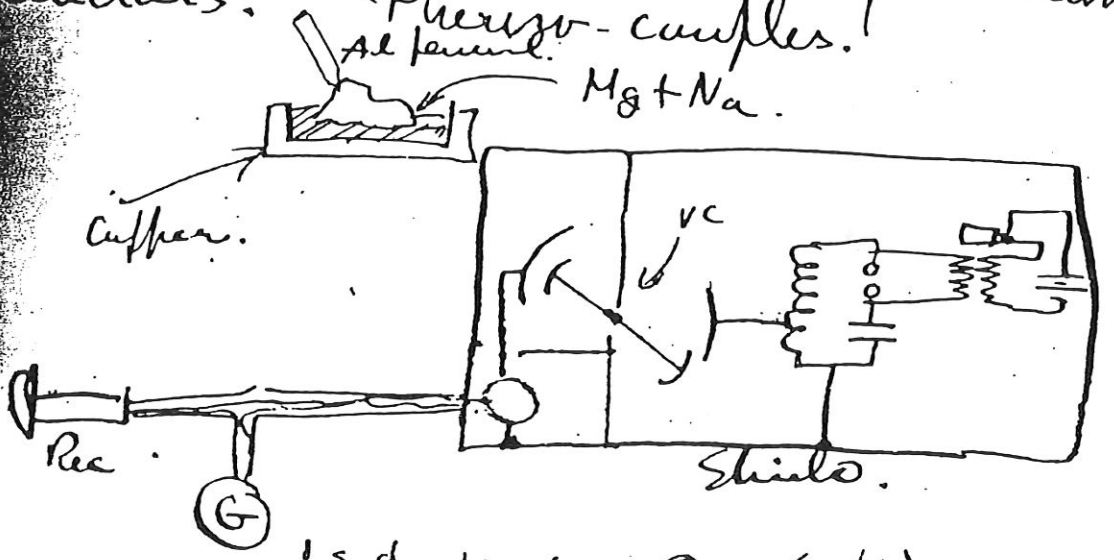


...loud response at points; a feeble response ...ld be obtained anywhere on the secondary ...uit is ¼ as loud as C. det. Operator ...d half as loud!

Sept 14/05

Wireless Telegraphy. Phys Examination

Detectors. Thermo-couples.



1 s.d 1v 500 Ω. (ap.)

Oxide coats on.

Pb		(40°)
Cu	Fair response; after candle is tried.	
Fe	Fair response	(30°)
Zn	Fair response	(30°)
Mg	Slight response	(45°)
Al (Cu pencil)	No response (?)	(45°).

Galv. deflection not always proportional to ~~relative~~ response.

Amesbury
Sept 14/05

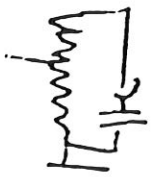
Oscillating Circuits
Impedance Occ. Trans. Primary.

When transformer is not wind, $l = 12.5$ cm, on
coil 237 turns on helix. With transformer, $l =$
2 cm for last turn. It would seem that
effect of coupling near large, from this
result.

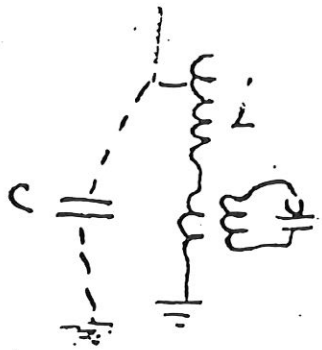
Amesbury
Sept 18/05

Tuning circuits

With antenna transformer of 105 in circuit, tuning with wavemeter frequencies as well limits as with station as:



Wavemeter could be used over almost the entire tuning helix.

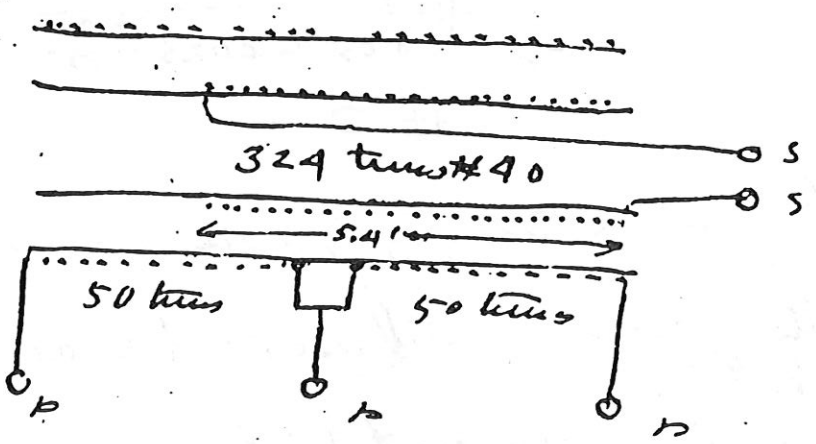


C = .00025 to .005 mf.
Although I much doubt the value for current limits of signals (C.C.)

Amesbury
Sept 12/05

Primary Circuits

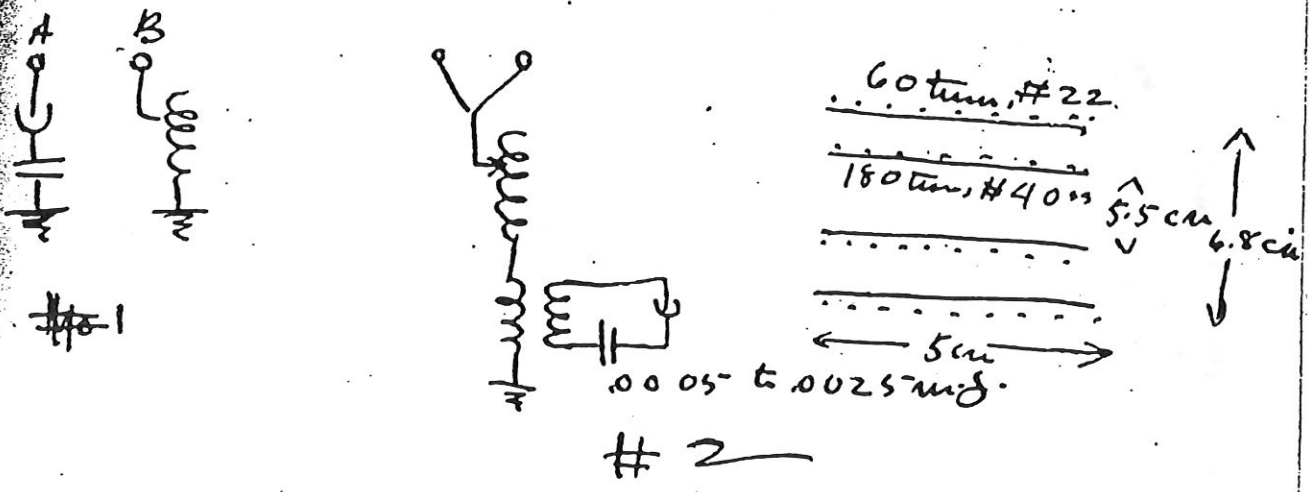
Same transformer as Sept 11, but with added turns on Secondary, no 100 turns, on core.



Ratios 1. 3.24, 1: 6.48 with half primary

Amerbury
Sept 11/05

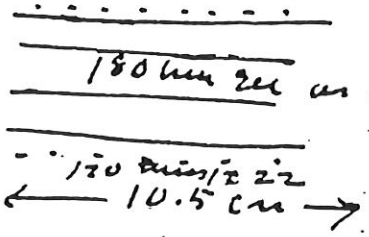
Tuning Circuits



With Switch Button sending, 1 and 2 are equal. #2 much louder.

With Wellfleet sending, diffuse not so marked, but #2 still better

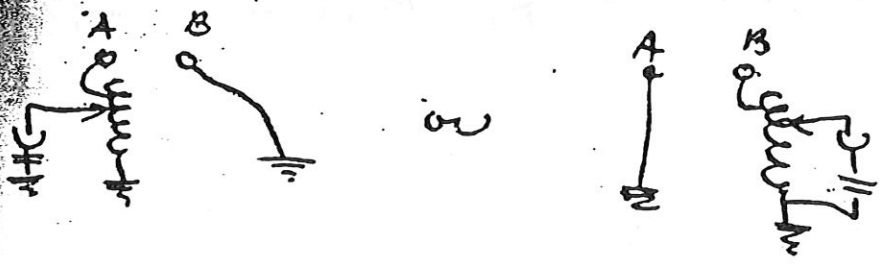
Same primary, in series with first



Gave better results with Wellfleet and mine, if not quiet as good, with S. Button. Tuning not so sharp as with two turn primary.

Amesbury
Sept 10/05

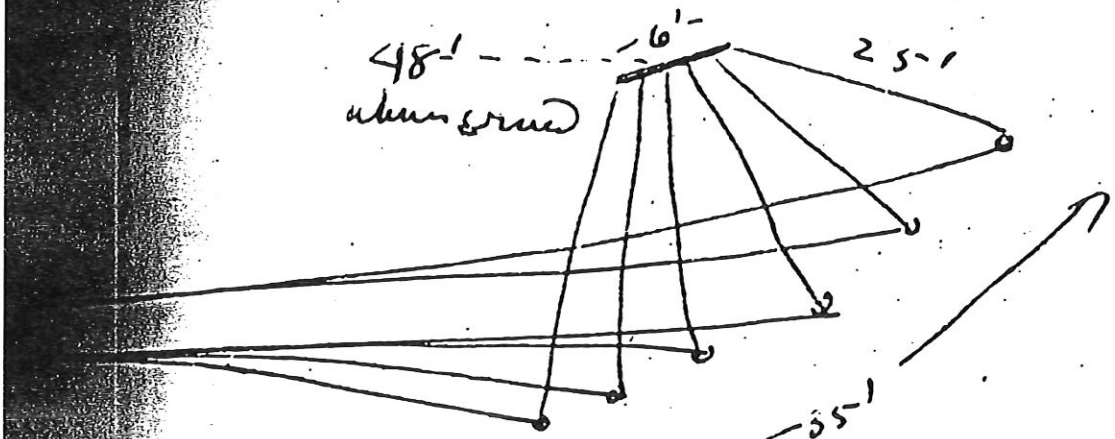
Receiving Antennae.



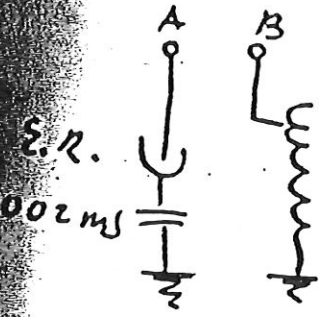
No sounds from Wellfleet could be heard with any adjustment of antennae.

Hornsby Sept 10/05

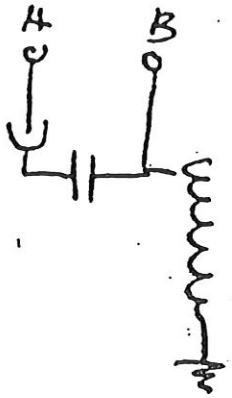
Antennae.



Each wire 75' long, #18 bare copper



20 cm of spirk layer #24 SS copper on wooden core 2½" diam
Etc 25 SS for Wellfleet.

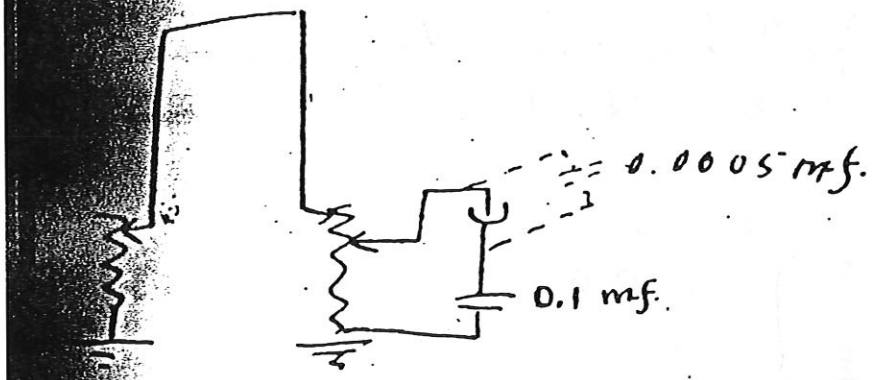


No sound could be heard.

Impedance of antenna evidently very small.

South Boston
Aug 9/05

...ders Telegraphy.



With Wellfleet sending 0.0005 mf. shunt
clicks increased sound in receivers, and sharpened
tuning noticably. Change to 0.002 mf. rendered
sounds in intensity was about the
same sharp tuning.

Same arrangement with Providence, R.I.
sending gave no gain, but a slight
decrease in loudness.

Aug 9, 1905.

Wireless Telegraphy
Detectors.
Magnetite.

Using same pulsed sample, galv. tuned magnetite – to ul. pin.

air condenser		galv.
10°	1×10^{-14}	0.00
20	2 "	0.15
30	3 "	0.20
40	4 "	0.24
45	4.5 "	0.25

$i_{a.c.\ R.M.S} = 2\times10^{-6}$ (approx)

$i_{d.c.\ galv} \quad 1.3\times10^{-6}$

Shows small efficiency as converter.

Aug 9, 1905.

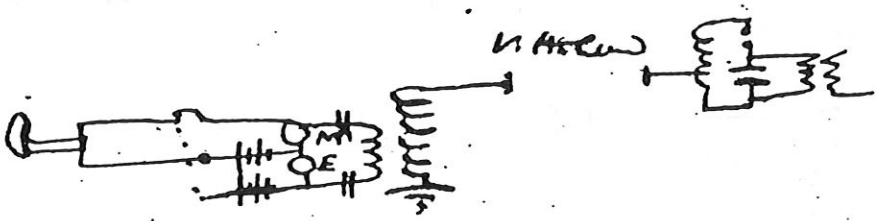
Wireless Telegraphy

Detectors.

Magnetite.

Owing to the high resistance of this mineral, it has been difficult to make detectors of sufficiently low resistance to be effective. A sample from Mayfield, polished by grinding and then coppered, the latter being washed off in a small crucible, by: [illegible] and [illegible] by

H pin, gave good results with 100 ohms and 2.3 volts. In series with electrolytic, gave about 20% rectify of latter.

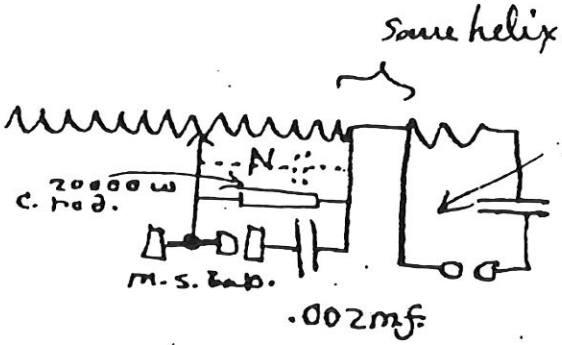


As thermo-detector, useful adjustment made intensity about 10% electrolytic.

July 27/05—

Wireless Telegraphy

Tuning circuit

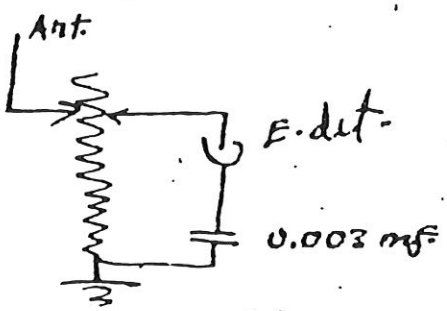


With N = 30-60 turns, max. spark length = 0.007"

Placing in shunt to 20000ω carbon rod a glass plate condenser of 0.005 mf., sharp resonance at N = 28.5 turns, and max. spark length of 0.01"

Using 0.005 mf. in place, but removing carbon rod resistance, sharp resonance attained at N = 30 turns.

This circuit is that of the detector unit in



On the assumption that E. det. is largely an ohmic resistance, it would seem that a properly proportioned condenser shunt would improve tuning

Jul 1/05

Telegraphy.

Exs -

Galena - Al.
Al point
Tufnol
Brass

Small flake of graphite
mounted al. point.

volts.

Good response to oscillator,
fairly constant. 1500 ω at
2.4 volts.

.02 - ohms.

80 s.p.s.

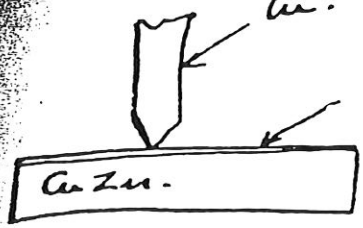
Without battery no first response
to oscillator. Turning screw
to 8 ohms, fair response.

Pencil streak
silver & Al.

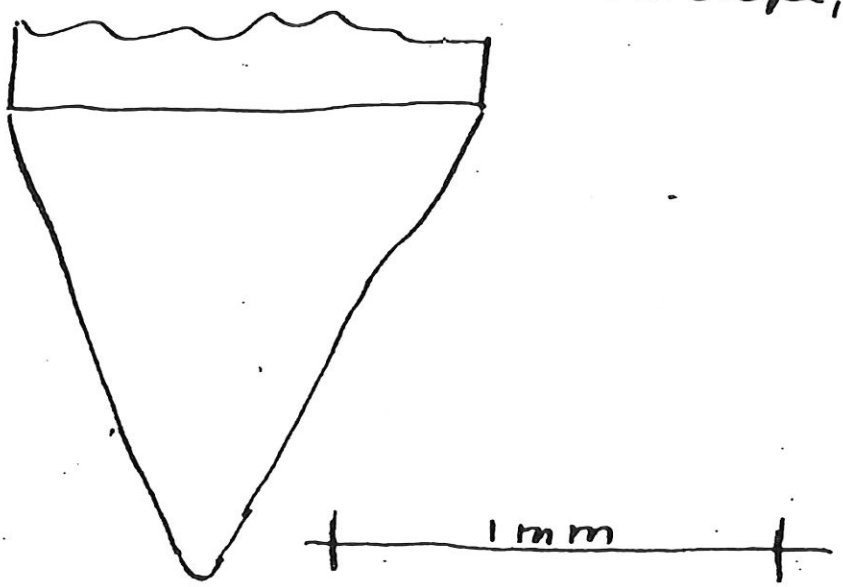
Found Hg surface, quality
from BB Faber pencil counts
heavily on this. Al point
as above. 1.7 volts best
resistance at this potential
400 ohms. Without battery
gave no response until
pressure was increased to
11 grms. Quite constant,
working for about an hour
before readjustment. Would not
find so good a spot again.

Auburn, May 27/05

...ectac. Physics Laboratory



...ated 20 min. just below melting point (...pper wire, #18, filed to sharp point, ...ed in oil-stain. Under microscope, fair

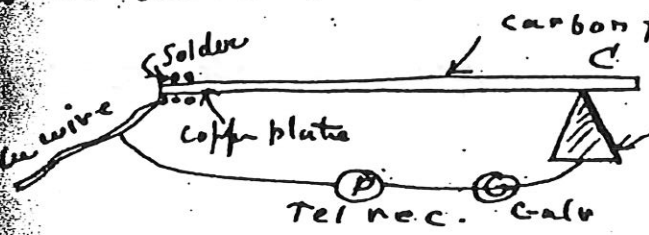


...ood response at times to oscillator, but difficult finding good effect.

...ave tried with Te layer (E.X.A), but ...ther and not so regular. Unmounted ...points, good response, second harder ...an Se. A + a point outside layer, dabbed Te Cu, Te Zn? good response.

Hinckley May 26, 1905

Iron-Steel detector

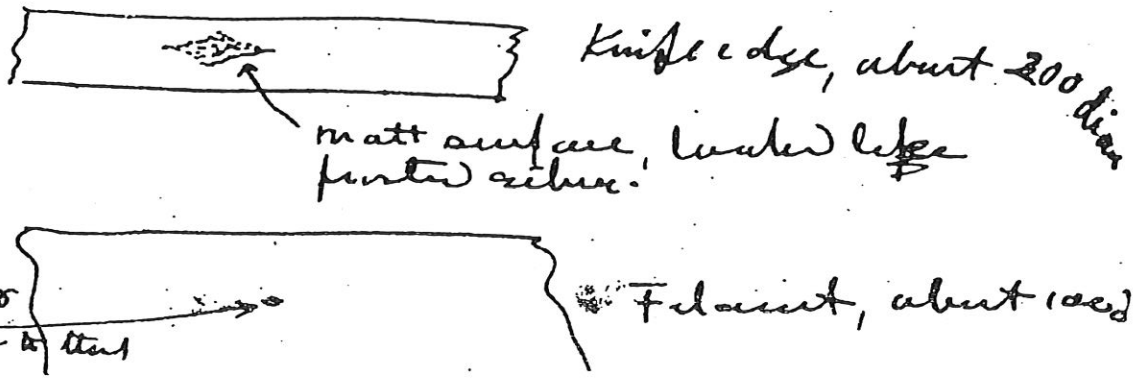


Gun pressure at C gave good response to all oscillations. Galv. showed $i = 50 \times 10^{-7}$ amp current flowed from carbon to steel across C. Response not constant, distinct fatigue in few minutes or even seconds. Moving point to fresh points on steel or carbon restored response.

Moisture present at contact considerably increases current.

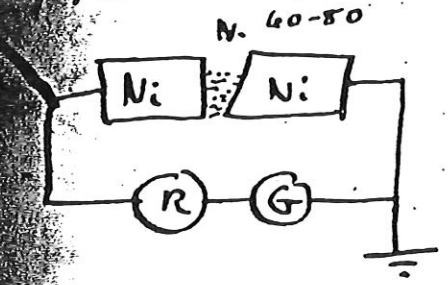
Heating contact by match flame gave strong current C to Fe across junction.

Microscope indicates fatigue is due to physical alteration structure of both Fe and C.



Aurburg, May 22/05

Thermo-electric action.



...ssing plugs together on filings, oscillator ...could be heard faintly at times in R. ...ft, some oxide I suppose, either on plugs ...ngs. and an unbalanced thermo-couple ...ltaic no distinct deflection of G.

Mar 19/05

Thermo-electric receiver

Cd - Bi

8:9 by weight

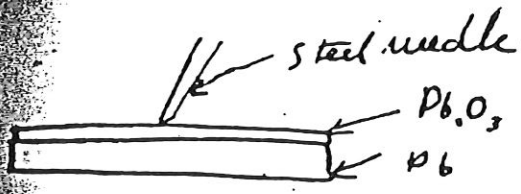
Fracture point of Bi, less than .001"
Quite stable, but not very
sensitive

Al - Bi

Al surface, Bi point as above pressed in
contact - (62 gms press) Better
Rounded Al point, pressed (59gm) against
polished surface Bi. Almost same as
Bi point. Point to adjust.

Feb 1/05

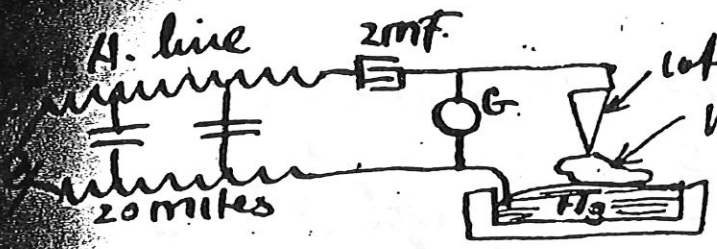
lytic Detector.



1.8 volts, marked loudly, current for the part decreasing while reining oscillations.

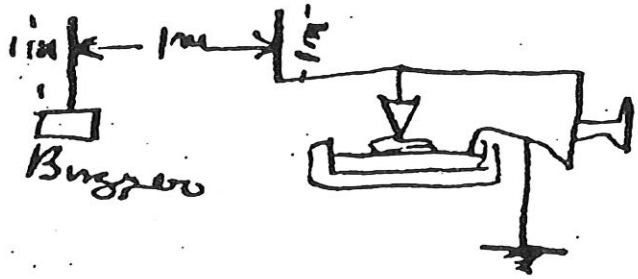
Dec 16, 1904

Feble a.c.



Magnetite
Silver, oxided surface
Copper, Educised "
Iron, oxidized "
Silver, Sulfide "
Graphite
Coke
Lead . PtO_2 "
Hl Al_2O_3 "

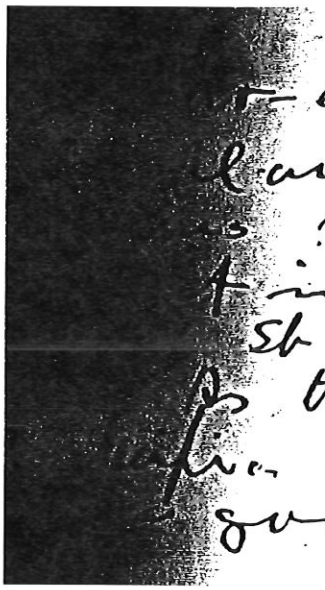
} with suitable adjust. could obtain slight deflection with all. Best with Cu_2Se.



Repeating above tests, using buzzer, 1m aerials, and Hl. rec, could secure response. Best with Cu_2Se and Ag_2S.

With line 30 miles, no result in any case.

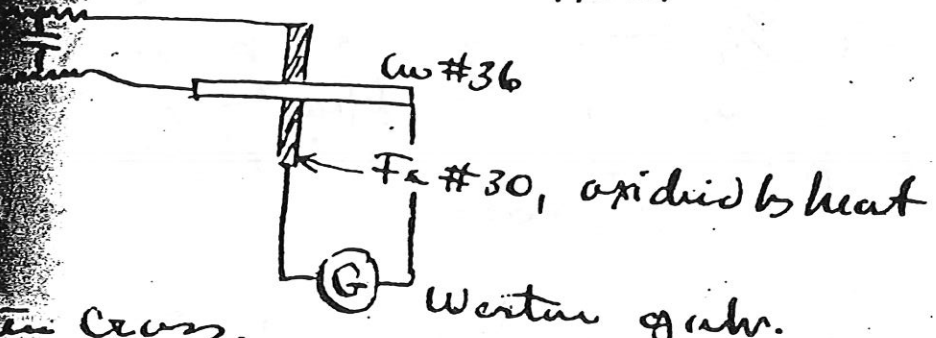
Jan 25/04



-electric receivers.
Lanca's mineralogy (1902)
metallic sulphides as detected
in thermo-electric series than
Sb or Bi.
the sulphides are of high
electric resistance, contact should
avoid detector.

Dec 15/04.

current Feeble A.C.

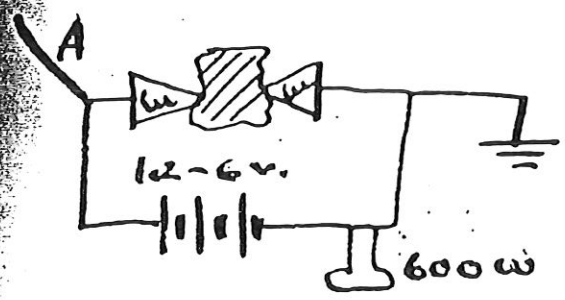


Western galv.

Ten cross. ac
1.5 m.a. required to give 1 s.d. on galv.
Int. tel rec. for galv, and making
copper wear by, could get clear
sparse. Varicle in action, partially
jarred.

Dec. 14/04

Magnetite Detector



Good response to 500 p.p.s. Shark. About as loud as cat-whisker coherer.

Magnetite obtained from Hurford.
Magnetite has high temp. Coef. resistance, and heating evidently changes res.

Reducing battery to 0. still obtain response. Evidently thermo-elect. action Cu-Fe_2O_3 junction. Response not loud but sharp.

Jan. 25/04

Thermo-electric Recievers.

Requisites.

High Thermo-E.M.F.

" Resistance

Experiments with C-steel show fair response. But neither T-E.M.F. or R is high.

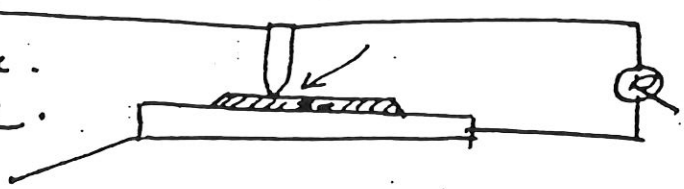
See list in Smithsonian Phys tables, 577 ed.

Se & Te are clearly indicated, in contact with almost any metal or other conductor.

High resistance contact should also be of limited volume, to give best results. See Elec 16/03.

Dec 16/03

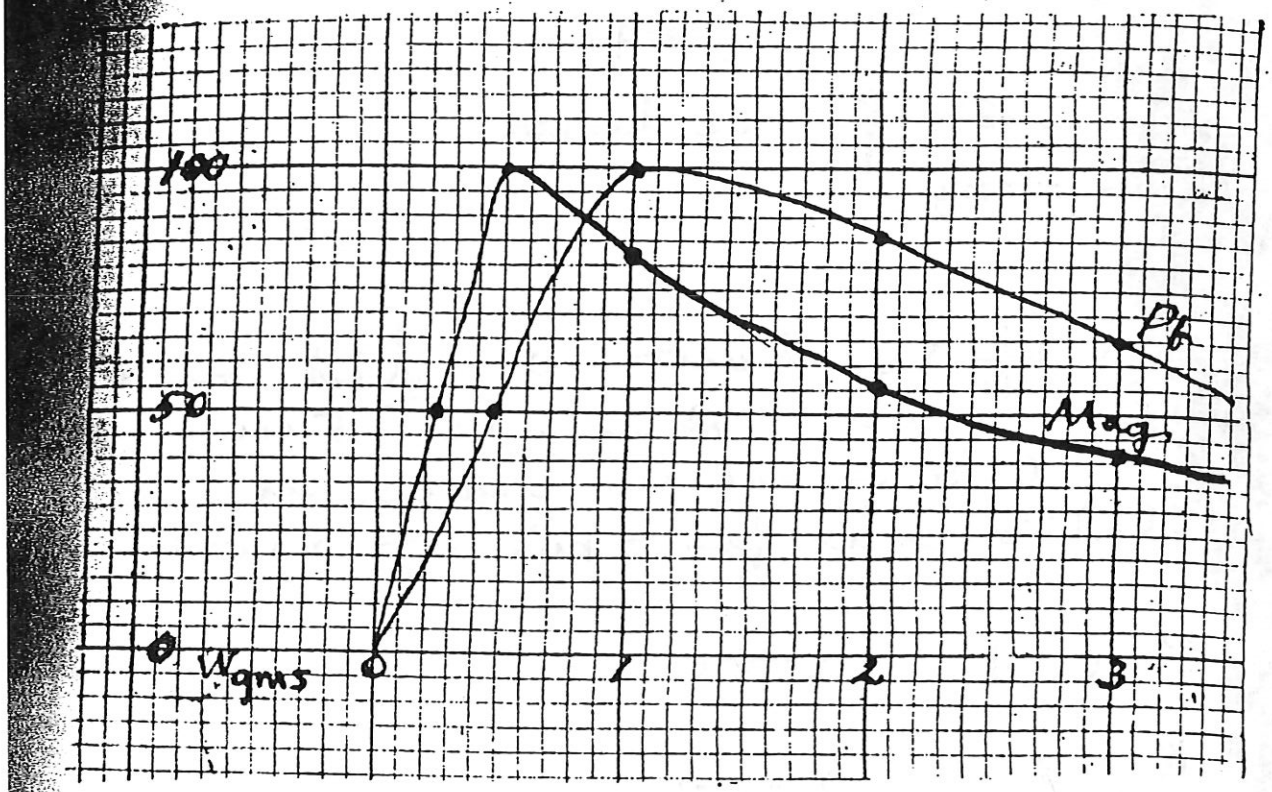
Bell Telephone -
receiver.
Sent from Hosford.

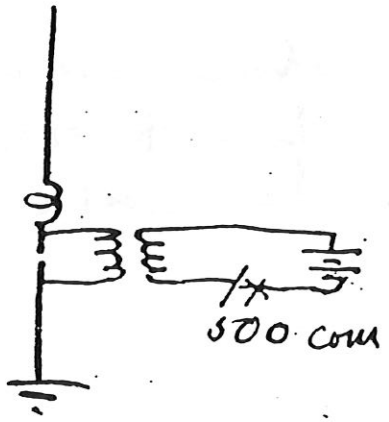


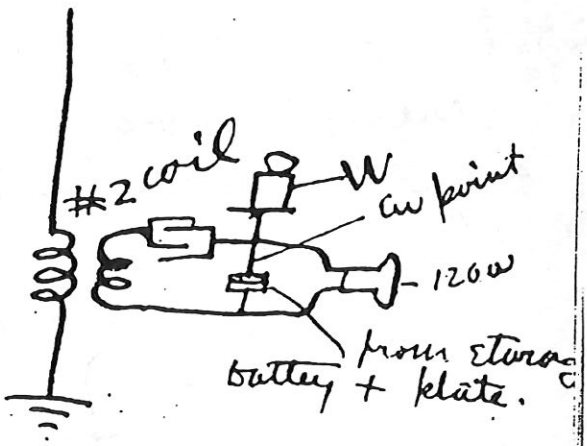
Wire fused on brass plate, copper
with needle point pressed in
contact, Fair results 5000 ohms.
Coil as used as rect. elect. carbon-steel
Coil.

July 8/03

Lead oxide detector



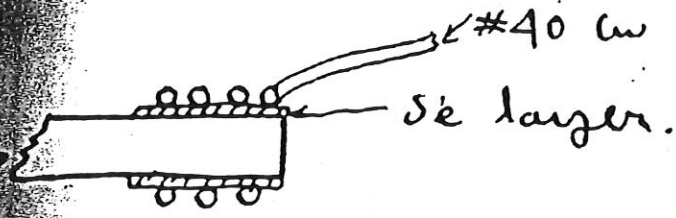




Pb shows broader pressure curve than magnetite, but max. not so high (Mag 100% = 2× Pb max.)

July 6/03

...um det.

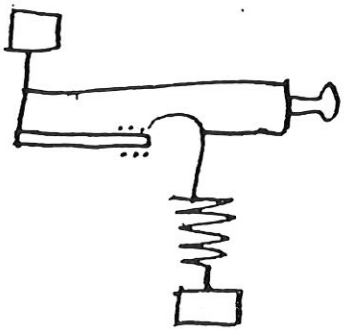


...layer of Se about .01" thick on end of 16 cu wire. Annealed 5 min at ... 6 turns #40 cu wound on, and ...nealed again for 5 min at 215°

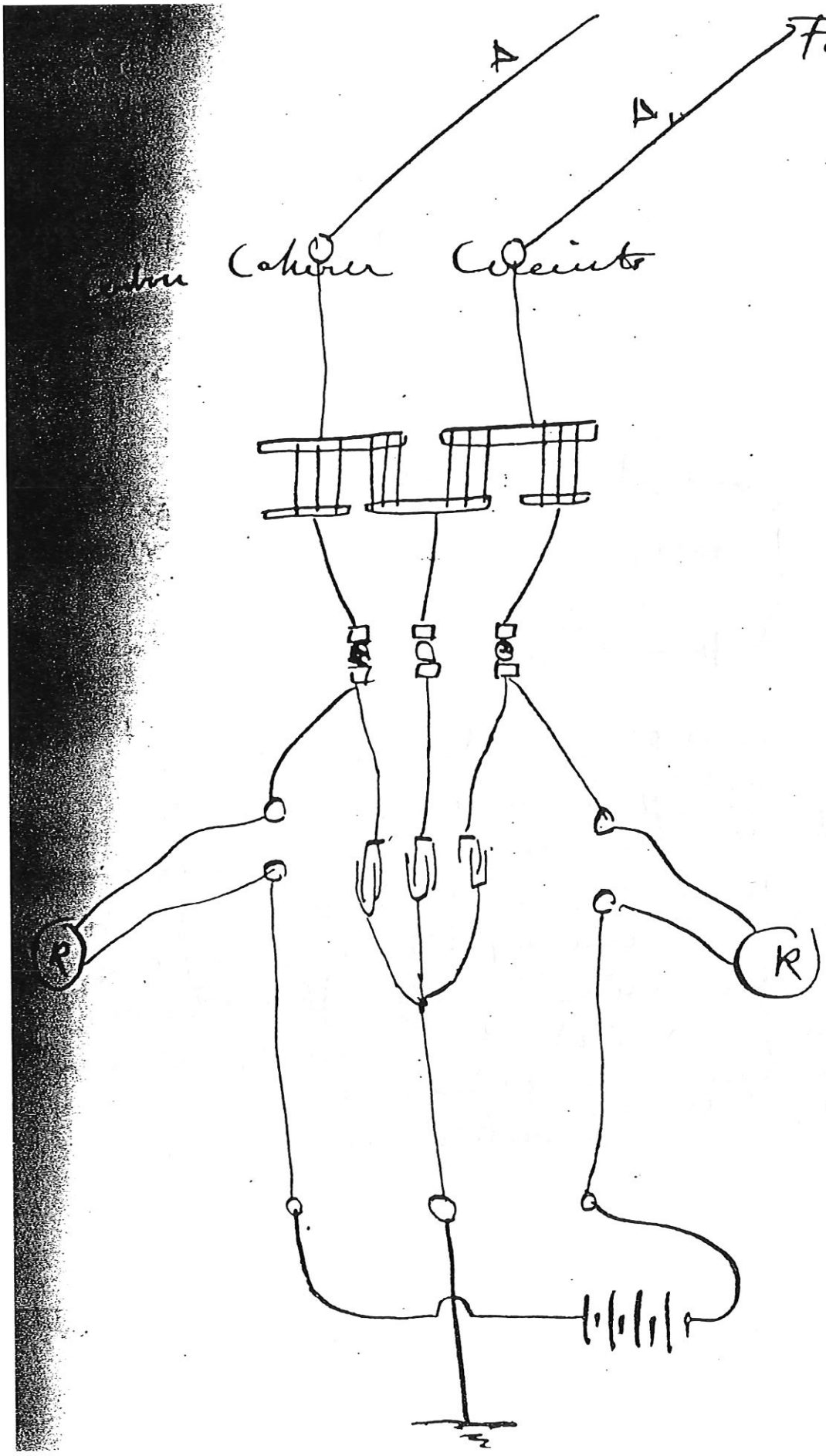
R_{dark} 8000

R_{light} 7000

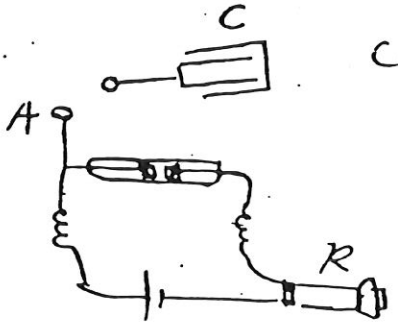
...5000 b-b-s Shark about 1.5×10^6 ... next room, very faint response ...winding all but 2 turns gave fair ...esp.



Feb 15th 1903



Nov 3 2 1902

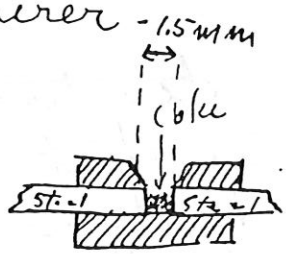


Coherer.

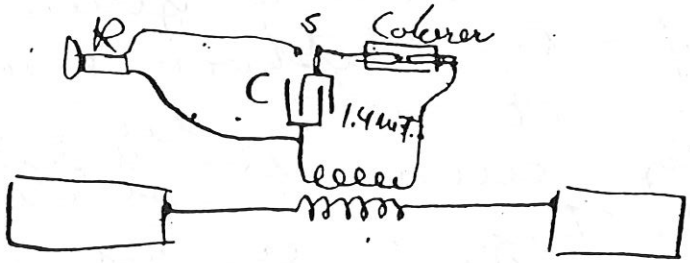
Using a small condenser C, connect outer coating first with insulated wire lamp socket on 110 volt circuit, and then with A, a sharp click could be obtained. Touching terminal of condenser to the outside of flexible cord lead to lamp on 110 volt circuit, it would become charged sufficiently to give a click in receiver contact with cord.

Oct 21st 1902

Iron coherer - 1.5 mm



Iron coherer, connected to a telephone receiver, without battery in circuit, gave considerable effects on the steel needle and carbon coherer of Oct 16th 1902, but considerably louder. One electrode was rotated at a velocity of 360° per sec.



Removing condenser C from circuit by S, and connecting to telephone receiver R, it was found to be charged if the transmitter in the next room was in operation. If the transmitter was stopped, no charge could be found in condenser.

Oct 17th. 1902

Coherer + other detectors

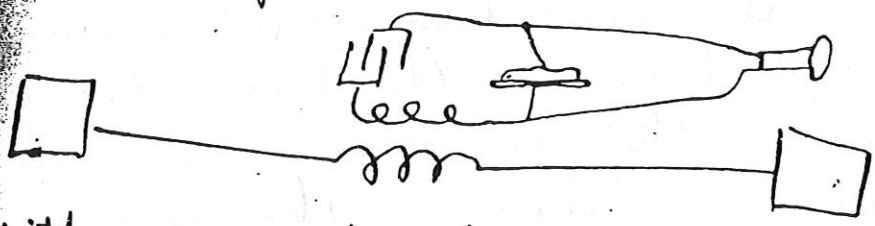
Potentially, a device that utilizes all of the energy of the Hertzian wave should be more efficient than a coherer. Such as are on the magnetic detector, the Platinum loop, should be capable of improvement to a vastly higher degree than any form of coherer. Although the Thermo-detector proposed (Oct 16th 1902) utilizes all of the wave energy, yet it should have, in study, to generate the current required for the telephone receiver, and not, as in the other devices, vary an existing current (as in the platinum loop), or disturb, by a sort of trigger action, the unstable equilibrium of a magnetized body, (as in the magnetic detector) The coherer is not much more than a trigger releasing a battery current, and although it only utilizes the peak of the potential wave it is, up to the present, the most sensitive, although perhaps not the most reliable, detector of Hertzian waves.

Oct 16th 1902

wave detector.

Oxidised steel surface of Jul. 25 is a layer magnetite, Fe_2O_3 Perhaps irregularity tion is due to thinness of layer, its puncture by mechanical or dietrical pressures.

A sample of lodestone, strongly magnetic, [illegible] from Chemical Dept, was [illegible] been into a sliver about $\frac{1}{10}$" thick, and laid on tinfoil, to duplicate oxidised surface of good conductor.



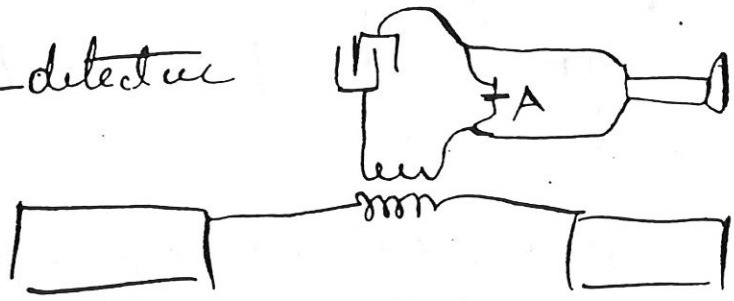
With 500μ spark response very regular and loud. Pressure of copper wire could be increased to about 8 times that possible on oxidised surface

Oct 16th 1902.

Carbon Coherer

In these experiments, sunlight falling upon the carbon coherer seemed to increase the slight discharge obtained on connecting the condenser and exciting it into the circuit. In the foregoing it is probable that the carbon-steel acts as a thermo-element, and the heating caused by the electric waves generates a slight current which reproduces the sound in the receiver. As this heating is to a certain extent permanent during the operation of the transmitter in the next room, there will be a steady P.D between the terminals of the coherer, and the condenser cannot be charged from this. This effect is not always an instantaneous one. Frequently the sound is almost imperceptible at first, reaching its maximum in 10-20 seconds, or longer.

Oct. 16th 1902



Using at A a light contact between the sharp edge of a copper wire and a brass surface, tone of spark is next room could be clearly heard.

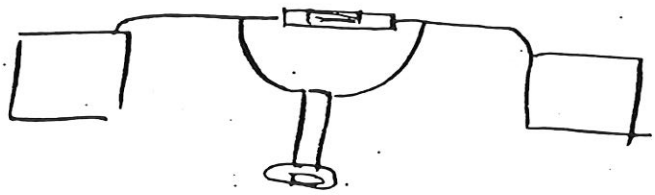
Steel knife edge and brass surface also gave results.

Steel needle on Brass, Nickel, and graphite gave results, best on the latter. Soft lead pencil used for graphite surface

Steel to iron occasionally created fine sound.

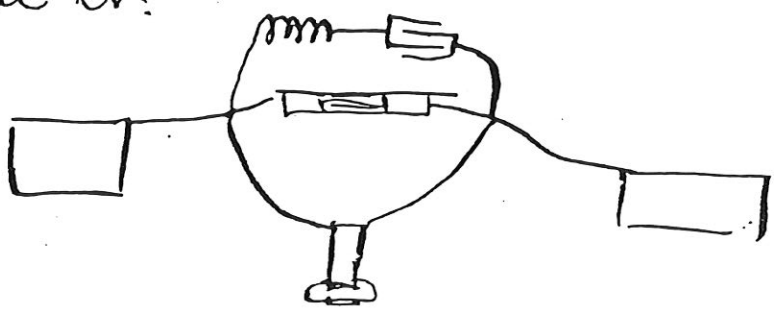
Oct 16th 1902

Iron Coherer



D

This gave very faint, almost imperceptible sound. Jarring would sometimes improve it.



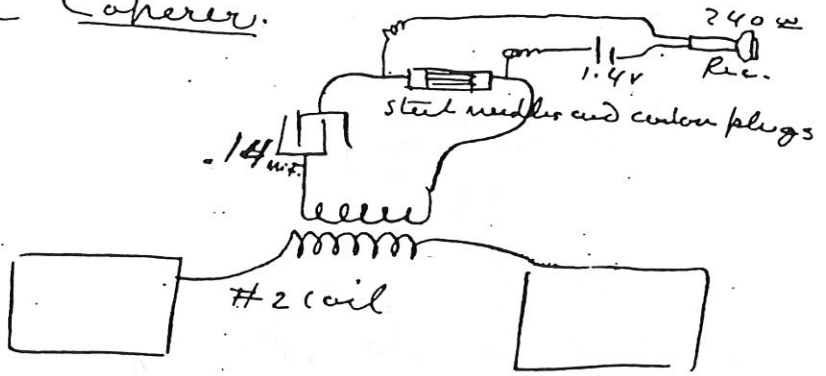
E

Addition of the inductance and capacity across the coherer increased the sound to nearly what B gave

In these tests without battery in the circuit the condenser seemed to become slightly charged, or that a decided click could be obtained on short circuiting it, i.e., when the connection at ⊕ in B was opened for a few seconds, and then closed. Studying the sparks in the next room stopped this charging action.

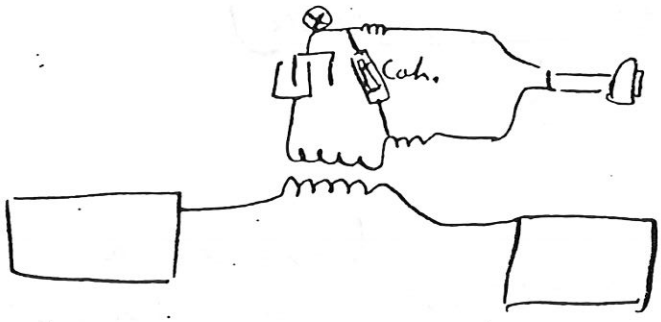
Oct. 16th 1902

Carbon Coherer.



A

This gave clear sound with 600 a record breaks in other room.



B

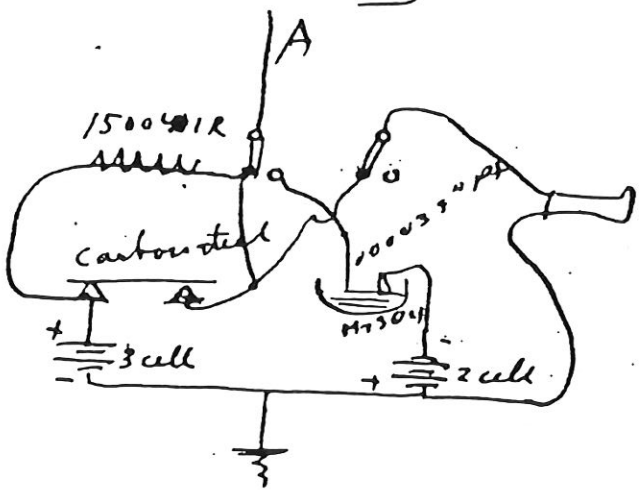
With battery cut out of the circuit this still gave the note, although faintly. Jarring the coherer increased the sound.

C

Without carbon steel coherer in this gave no sound whatever.

Sept 26th 1902

Wireless Telephony

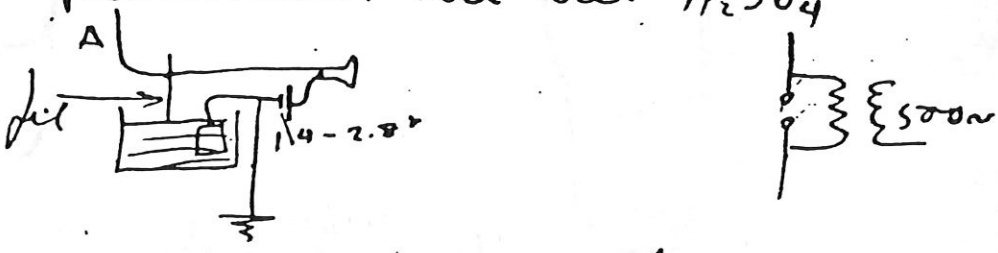


Comparison on above circuit made carbon-steel 3 times, on board at times. Substituting for the steel needle on carbon blocks the rotating electrode of Aug 21st 1902, the gain was much greater. The fine wire in acid seemed slightly smoother than the rotating electrode coherer.

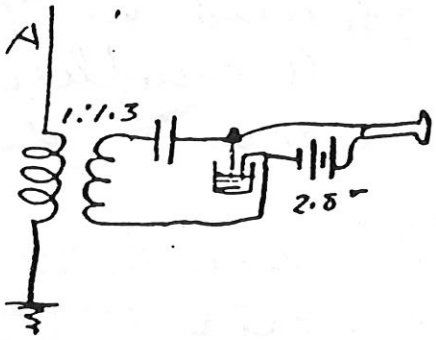
Sept 24th 1902

...eless Telephony

Carbon filament in dil H_2SO_4

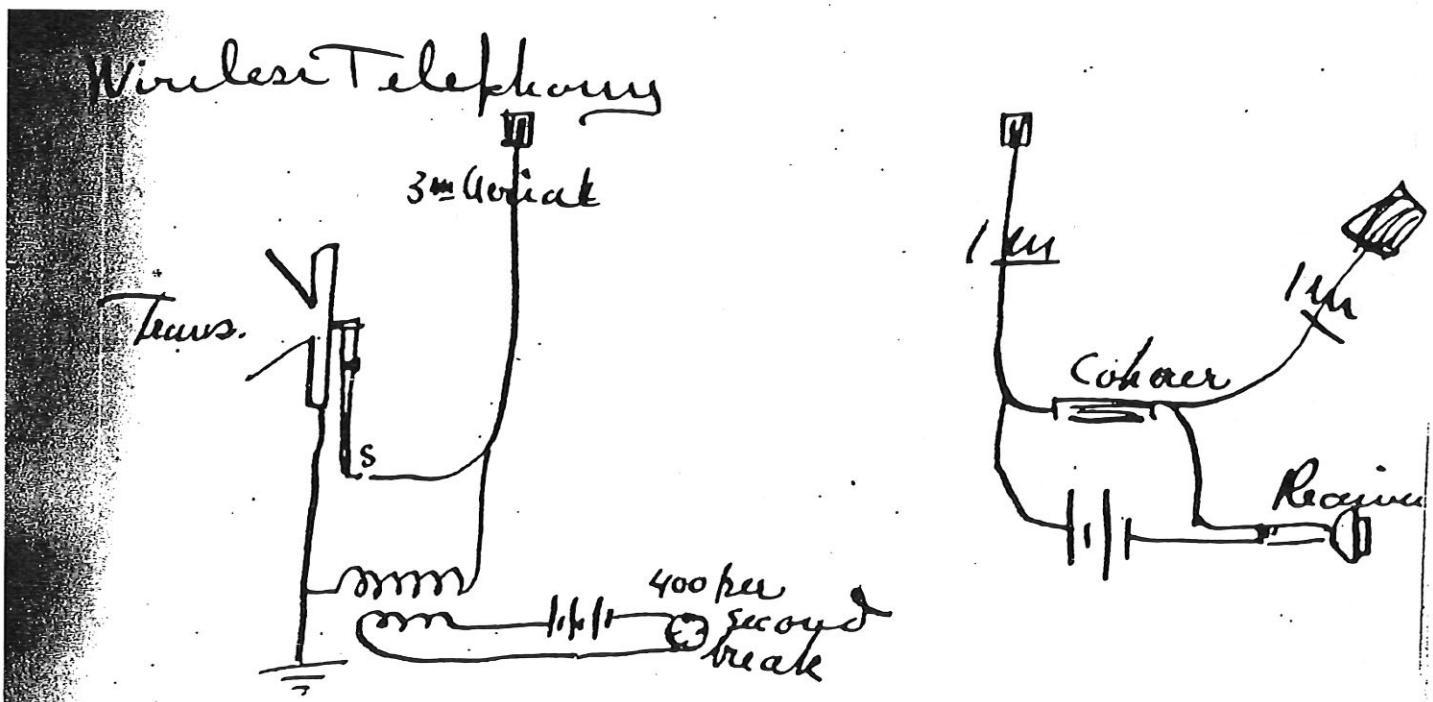


...when just in contact with sol: a ...t note could be heard. This soon ...ed, probably because of melting the ...bon. Same with pt wire .000038" ... circuit:



...gave louder note, and was ...ite regular in action

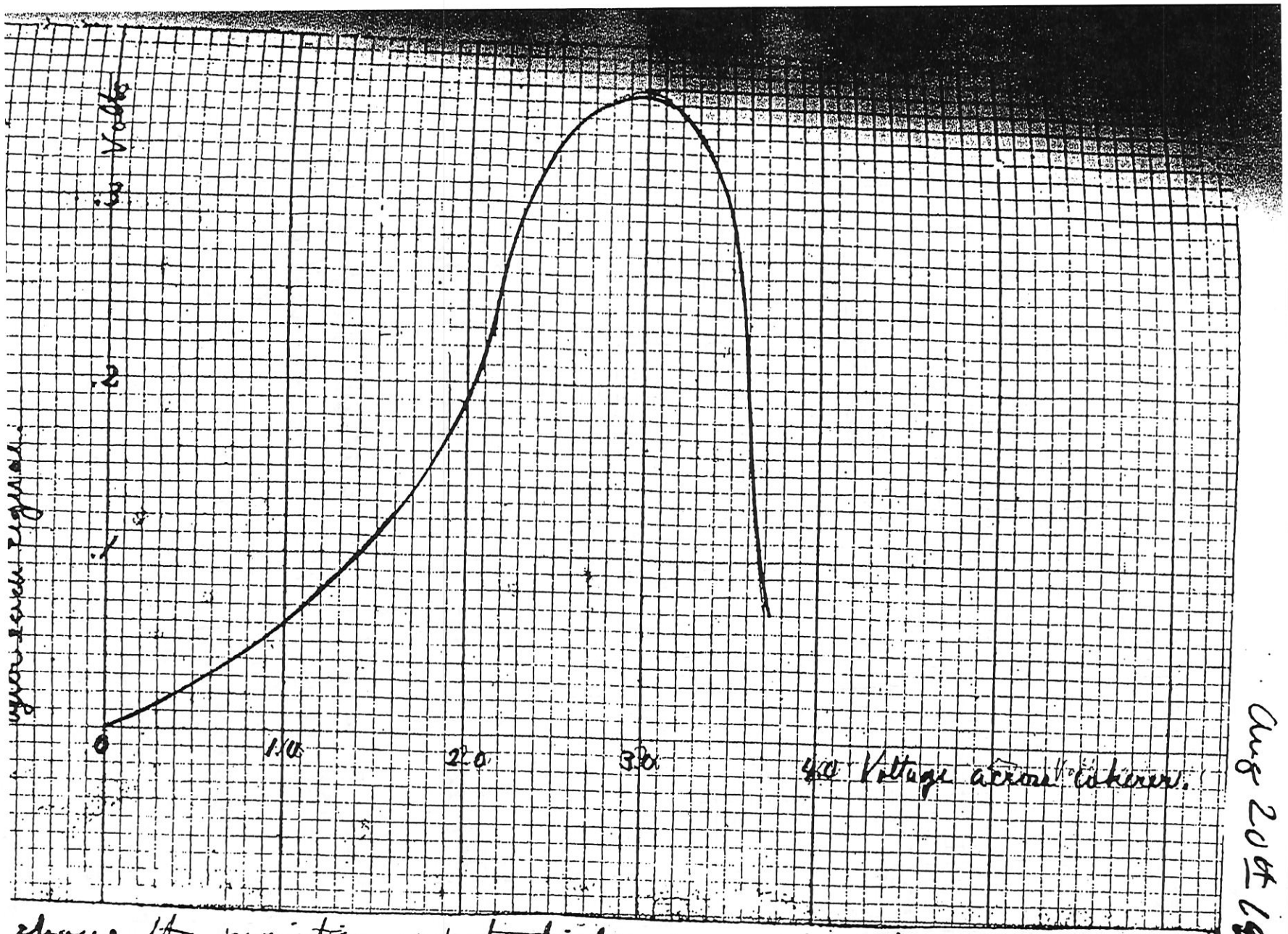
Sept 6th 1902



With the apparatus shown in above sketch, tones and articulation of the voice were transmitted between rooms. Counting "1, 2, 3 - - -" was heard clearly, and at times loudly in the receiver. A complete sentence was in one case received (How do you get me?)

The undersigned have listened at the receiver, and have noted that both tone and articulation were present.

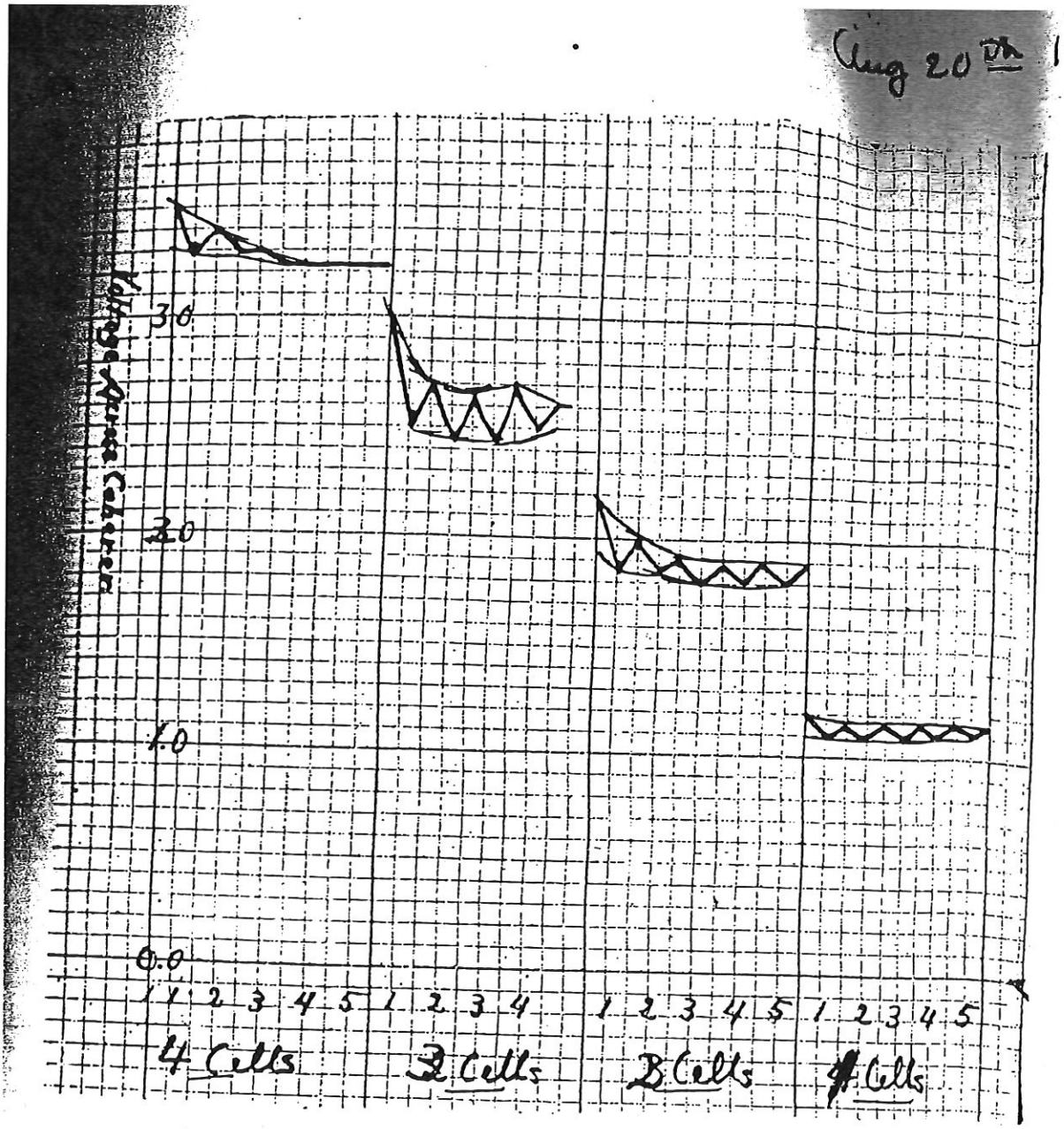
John A Barrett H. C. Shreeve
F. M. Durkee.



Aug 20th 1902

shows the variation in potential across a carbon-steel coherer, different voltages, the coherer being tapped after each signal. — evidently gives a maximum effect.

Aug 20th 1902

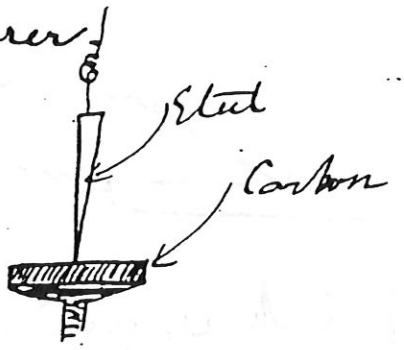


This shows the variation of potential across the carbon-steel coherer with each successive impulse from a transmitter, the coherer not being tapped between impulses. With 4 cells, after the 3d impulse the coherer did not respond at all, as may be seen by the straight line after the 3d impulse.

Data from July 23d 1902.

July 31st 1902

Carbon Coherer

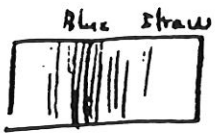


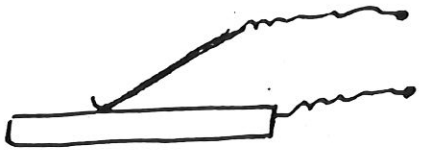
Rotating the needle on the carbon gives greatly increased sound in the telephone, as well as one extremely uniform one. With a speed of 45° a second, the sound caused by the rotation did not interfere with receiving. If the lower electrode were revolved by clock-work or so as to secure a smooth motion, a great increase in the sensitiveness would be attained.

Using the 6 volt Battery, adjusted to give a musical note of low pitch (about 200-300) the sensitiveness of the coherer seemed to be increased over 100%, and the musical note was given with great clearness.

JUL 25 190

Steel coherers.

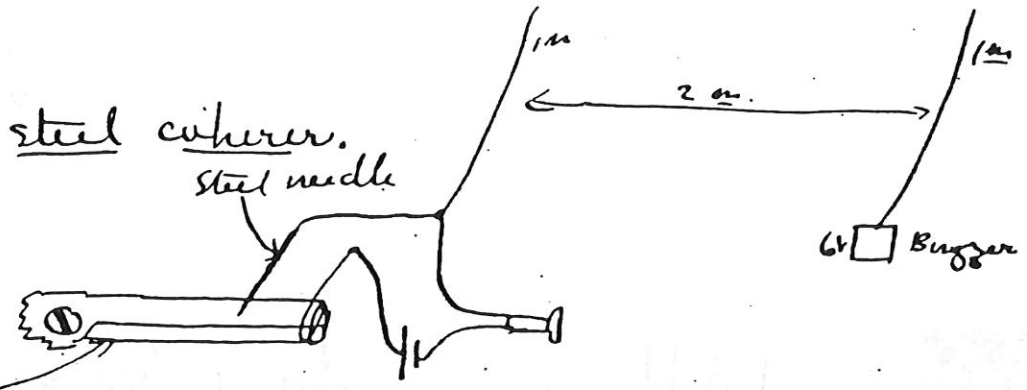




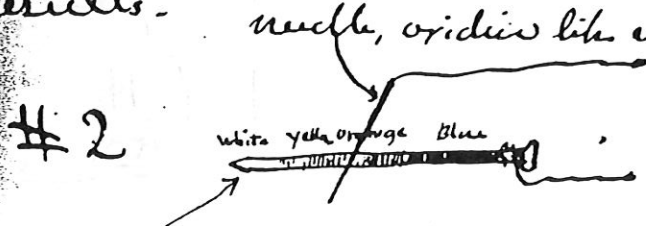
A flat bit of file steel was polished, and heated at one end until the surface took on "temper" tints - blue to light straw. Small needles were similarly treated, also a little piece of file. Under normal conditions this made a very sensitive and loud coherer, using one cell again. The loudest sounds were when the needle point rested on the straw colored portions, but were not quite as distinct as when on the orange - blue tints. There was also more microphonic sound on the yellow-straw colors. The coherence and decoherence seemed to a certain extent independent of the amount of pressure.

July 25th 1902.

Steel to steel coherer.



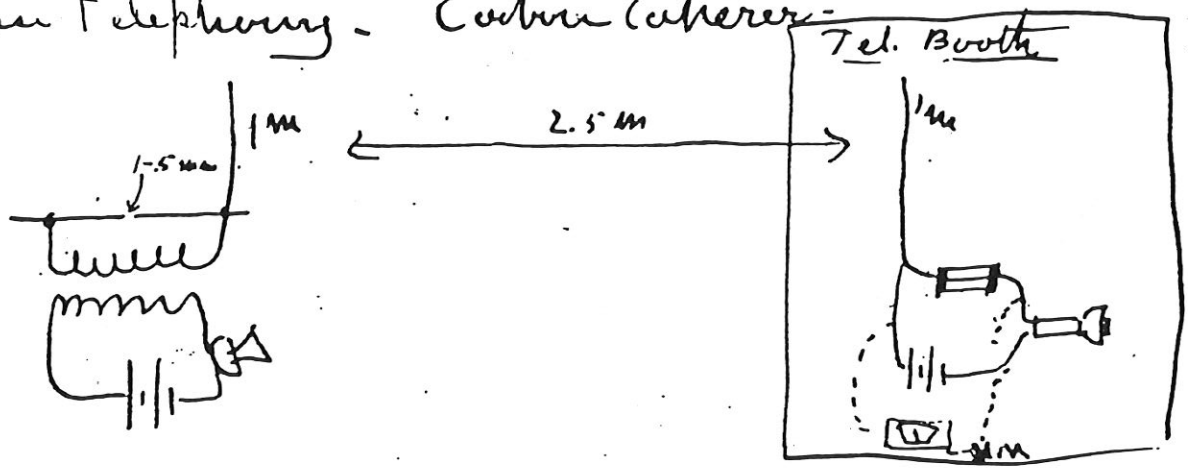
This worked well, clearer and louder than the carbon-steel coherer. Clean steel surfaces gave no results.



This worked even better than needle and scissors. It seemed, within very wide limits, independent of the pressure. Squeezing the nail and needle together between thumb and fore-finger did not alter the clearness of coherence and de-coherence, and even seemed an advantage, as it entirely eliminated the microphonic sounds so annoying in most single contact coherers. Only a single cell of Ag Cl battery would be used in circuit - 2 broke down the oxide film -

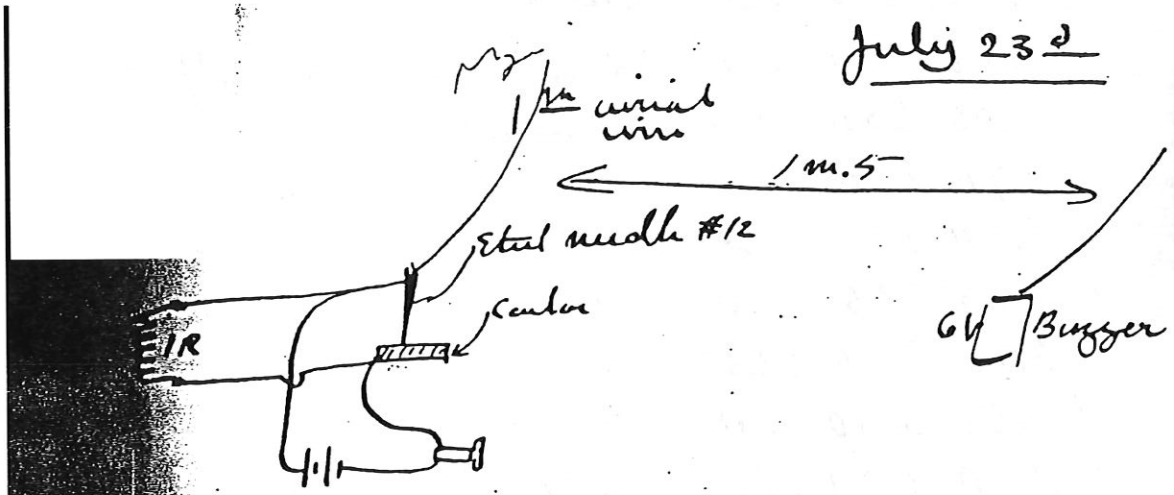
July 24th 1902.

Wireless Telephony. Carbon coherer.



Faintly clear tones were received in counting, and one observer thought there was a trace of articulation. A whistled tune came out clearly - With two cells of Gold saying "hello" in the transmitter, with a 0.5 M.M. spark, would lower the voltage across the coherer from 2.1 to 1.95 volts - fall of .2 volt. The former value would not be automatically regained, but tapping would be required. In 2-10 seconds the voltage across coherer would rise from 1.95 to 2.00 in 2.05. but no further.

July 23d

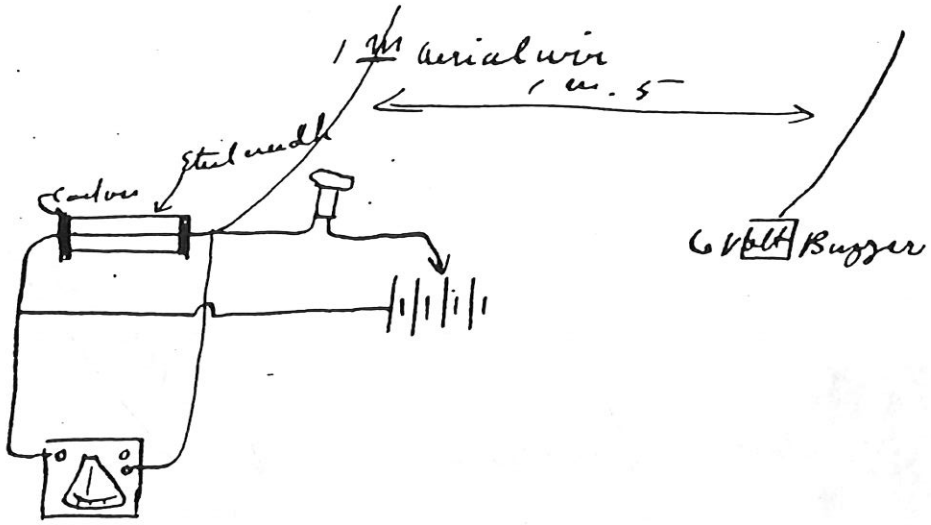


With a carbon and steel point coherer, the loudness and clarity of the signals was much improved by an adjustable resistance shunt 1R of from 300 – 2400 ω. This also cut down microphonic sounds.

July 23rd 1902
Continued

Gill Cells	Elevat.	cub.	Fall	sound	
2	1.90	1.80	.10	Faint Click	Not tuffed
3	3.00	2.50	.50	Clear-loud	" "
"	2.70	2.50	.20	" "	" "
"	2.70	2.45	.25	" "	" "
"	2.65	2.45	.20	"	" "
"	2.75	2.50	.25	"	" "
4	3.50	3.30	.20	"	" "
"	3.40	3.30	.10	Faint	" "
"	3.30	3.25	.05	V. "	" "
"	3.25	3.25	.00	No sound	" "

July 23d 1902



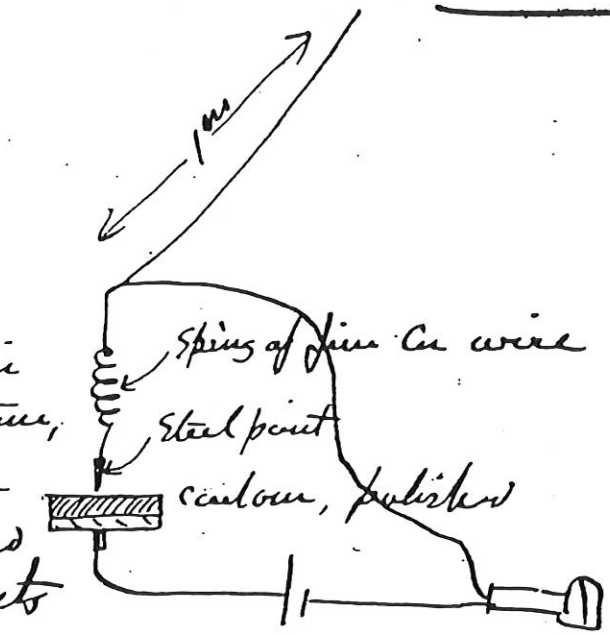
Obs	Dg? Coh. V_1	Coh. V_2	Fall V_1-V_2	Sound ~~than sound~~		Remarks —
1	1.20	1.15	.05	clear		Coherer in perpendicular position
"	1.20	1.10	.10	"		" " "
"	1.15	1.10	.05	"		" " "
"	1.20	1.10	.10	"	.08	" " "
"	1.15	1.10	.05	"	"	" Horizontal "
"	1.15	1.10	.05	"	"	" " "
"	1.20	1.10	.10	"	"	" " "
"	1.20	1.10	.10	"	"	" " "
2	2.15	1.95	.20	faint		" " "
"	2.15	1.90	.25	"		" " "
"	2.15	1.75	.40	"		" " "
"	2.15	1.90	.26	"		" " "
"	2.15	2.00	.15	clear	.23	" Perpendicular "
"	2.15	1.95	.20	"		" " "
"	2.10	1.90	.20	"		" " "
3	3.00	2.75	.25	"		" Horizontal "
"	3.00	2.40	.60	"		" " "
"	3.00	2.50	.50	"		" " "

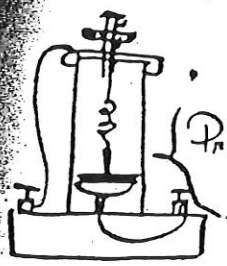
July 18th 1902

Carbon coherer –

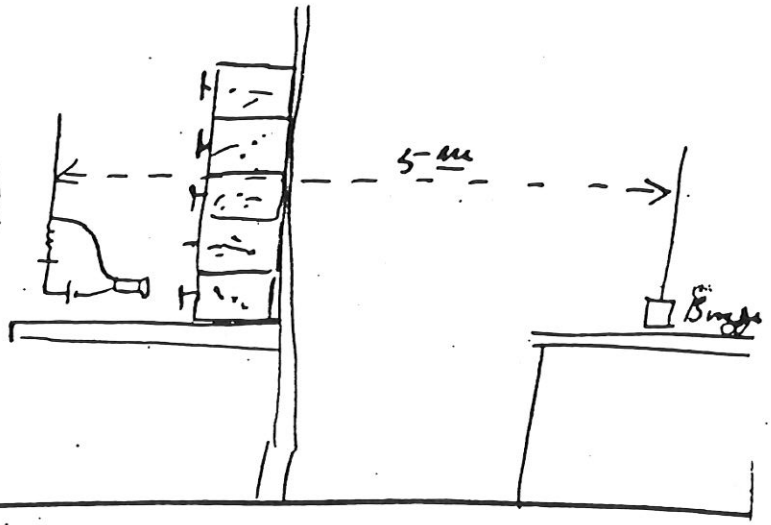
(see 17th)

Quite small bigger, this worked well at 5-m distance, through a wall and cupboard of drawers filled with metallic instruments below –



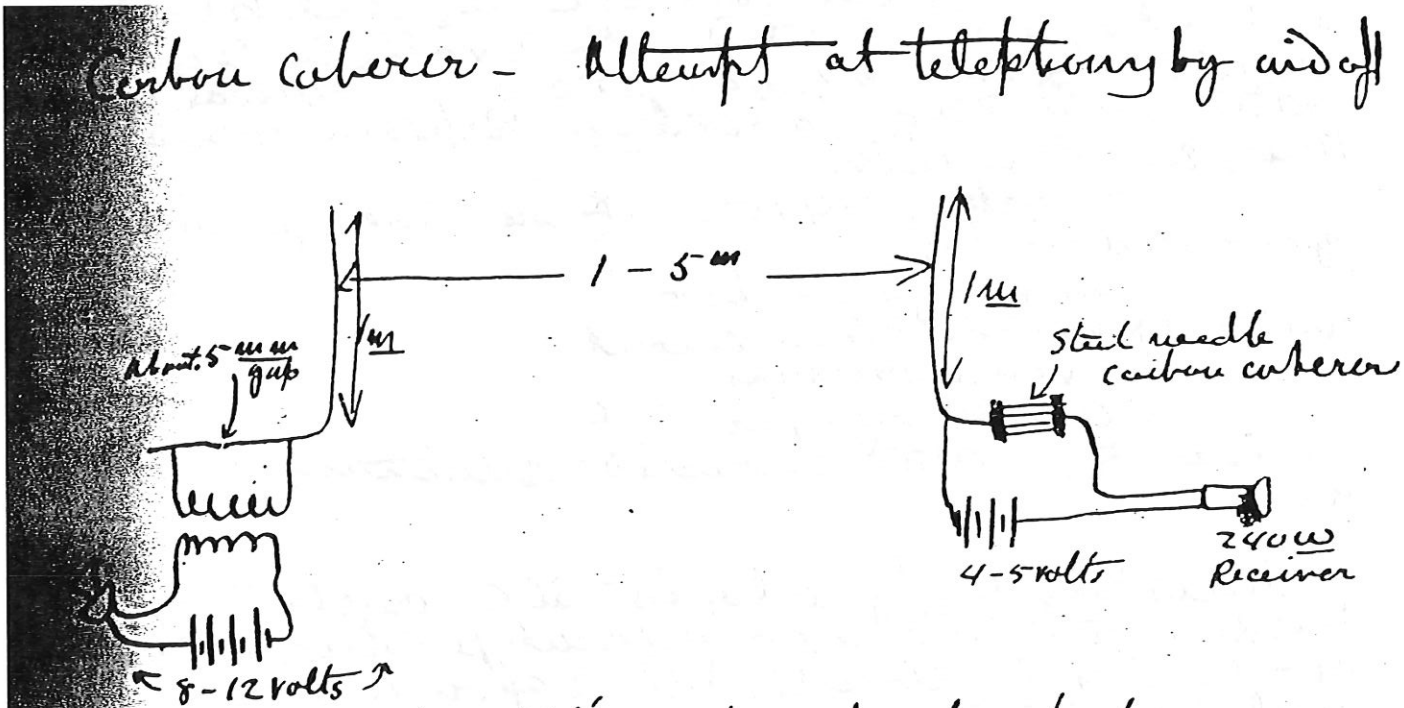


(Proposed form of this coherer.)



July 18th 1902

Carbon coherer - Attempts at telephony by aid of



tones could be distinguished clearly, but no articulation. Shorter spark gaps gave best result. With a loud tone, coil would give a spark some 3-5 mm in length - About 2 ampères was the maximum current in the transmitter circuit -

Wireless Telegraphy. Aug 28/06
Silicon Detectors. Carborundum, etc.
Must test adjustment after 1 minute trial
0.3 v 475 m.m.f.

.00043 erg per dot.
or 430 micro-ergs per dot.

Small, neatly cubular Si C crystal placed in holder, and adjusted with 2 volts in local circuit to give response to c.c. Removal of battery stopped sigs. absolutely. Repeated several times, same result.

5.5 volts v 475 m.m.f condenser, just gave audible dot.
= 0.14 ergs per dot.
With 1.8 volt in local circuit
1.7 volt 0 475 m.m.f
= 0.014 ergs per dot.
Evidently, battery increased sensitiveness 10 times.

Inverting deeply colored Si C crystal in holder, and testing at different positions, with no battery in circuit, faint response to c.c. could be obtained, about 30% as loud as Si occasionally. Probably a reduction of Si C to Si at places on the mass.

Telephone receivers placed directly across receiving circuit, no other detector or battery.
30 v 475 m.m.f
4.0 erg per dot.
Telephone receivers are evidently some 10 millions times less sensitive to 130,000 v current than to a direct current of the best duration (0.25 x 10⁻⁴ erg per dot)

Wireless Telegraphy. Aug 24/06
Received Energy

Measuring as per method of 230 the energy per dot from C.C.

V = 2.0 v for balance. (corrected for battery)
W = ~~0.019~~ ergs per dot. (0.042)

Over twice the energy received last night. Checked this estimate by use of Si detector, adjusting balance as before by change of 2.0 volts on condenser.

Aug 25/06

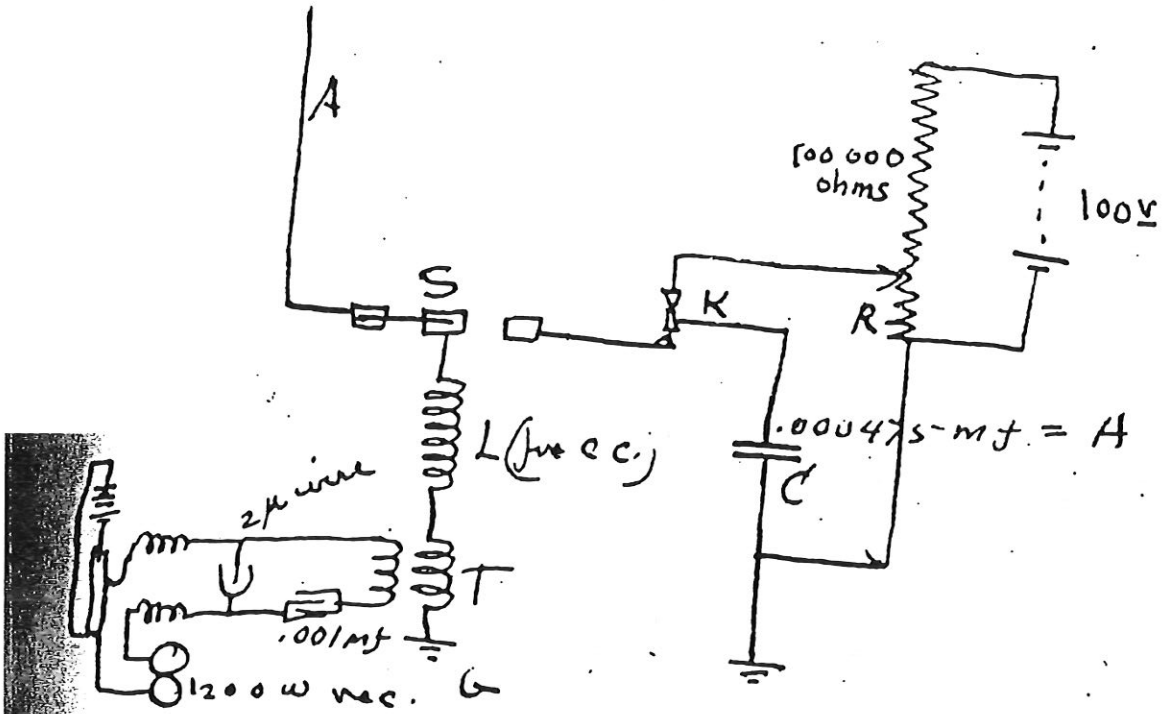
10.30 A.M. C.C.
~~0.019~~ ergs per dot (0.042

Aug 28/06

10.10 P.M. C.C
checked against Marconi call
2.5 v 475 mmf.
0.03 ergs per dot

Wireless Telegraphy.
Received energy.

Aug 23/06



Condenser C, charged to a known voltage by shunting across R, discharged through L & G by pressing K. As potential is low, and wattless, only spark a few mm in air the velocity of pressing the key being about 30 cm p.s. ~~does~~ closes circuit in less than micro-second after shunt opens, thus preventing damping of spark. Frequency is about that of C.C, as capacity of C is that of A. C.C. s dots, with S thrown to left, were balanced against dots produced by R with switch thrown to right. With balance in sound intensities, R = 1300 ohm, V = 1.3 volts.

$$Q = VC = 1.3 \times 475 \times 10^{-12} \text{ coulombs}$$
$$W = V^2C = 1.69 \times 475 \times 10^{-12} \text{ joules}$$
$$= 8 \times 10^{-10} \text{ joules}$$
$$= \underline{8 \times 10^{-3}} \text{ ergs.}$$

Corrected for both valleys
$= 17 \times 10^{-3}$ ergs.

Energy received from Wellfleet, per dot, on Amesbury Antenna, is ~~.008~~ .017 erg.

Same cond... c ...

Wireless Telegraphy.
Current in Receiving Antenna.

Aug 23/06

According to Duddell & Taylor's experiments, working with a wavelength of 400 feet, the product of energy × distance is approximately a constant at distances over a mile. At this distance, a transmitting antenna 42 feet high, and a receiving antenna 56 feet high being used, a received current (not tuned) of about 50×10^{-6} amperes, in a Duddell thermo-galvanometer of about 1000 ω resistance. On this the following extrapolation may be made.

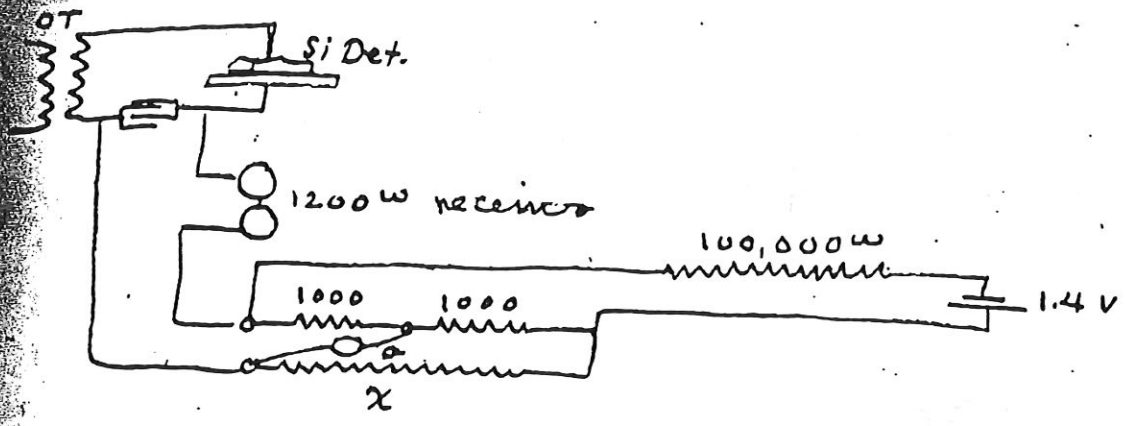
Distance	Current	Energy	Post Card
1 mi	50×10^{-6}	25. ergs p.s	1 erg.
10 mi	5×10^{-6}	0.25 " "	0.01 "
100 mi	0.5×10^{-6}	0.0025 " "	0.0001 "

It seems probable that the major portion of the energy received was dissipated in the heating resistance of the thermo-galvanometer.

When tuned receiving antenna was employed, the received current at 1 mi became 80×10^{-6} ampere, and the received energy measured by the galvanometer became 64 ergs p.s. or more than double. It seems likely that excessive damping in the receiving circuit, caused by tight coupling of thermo-galvanometer circuit to antenna, is responsible for so low an increase.

Wireless Telegraphy
Silicon detector
Resistance.

Aug 22/06



Balance was obtained with $x = 5000\ \omega$ when detector was in most sensitive condition. $100\ \omega$ change in bridge readily noted as small mm change in deflection

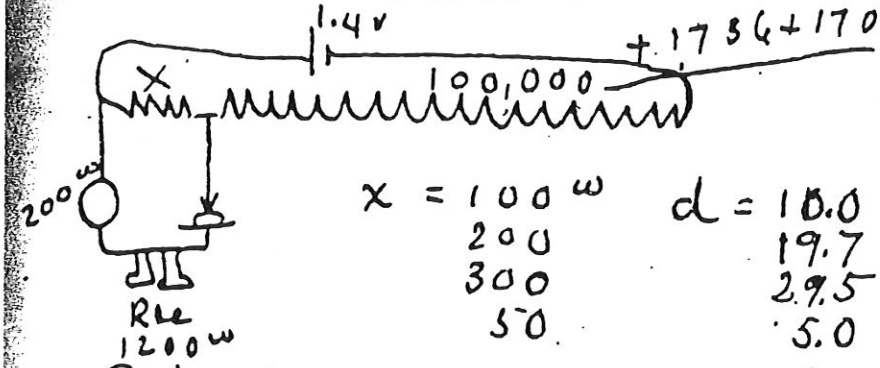
$R_{det} = 5000 - 1200 = 3800\ \omega$

$i_{det} = V/100{,}000 = 2.4 \times 10^{-6}$ amp.

$v = \frac{1}{2}V$

$V = .023$

$v = .012$ volt



x =	d =
100 ω	10.0
200	19.7
300	29.5
50	5.0

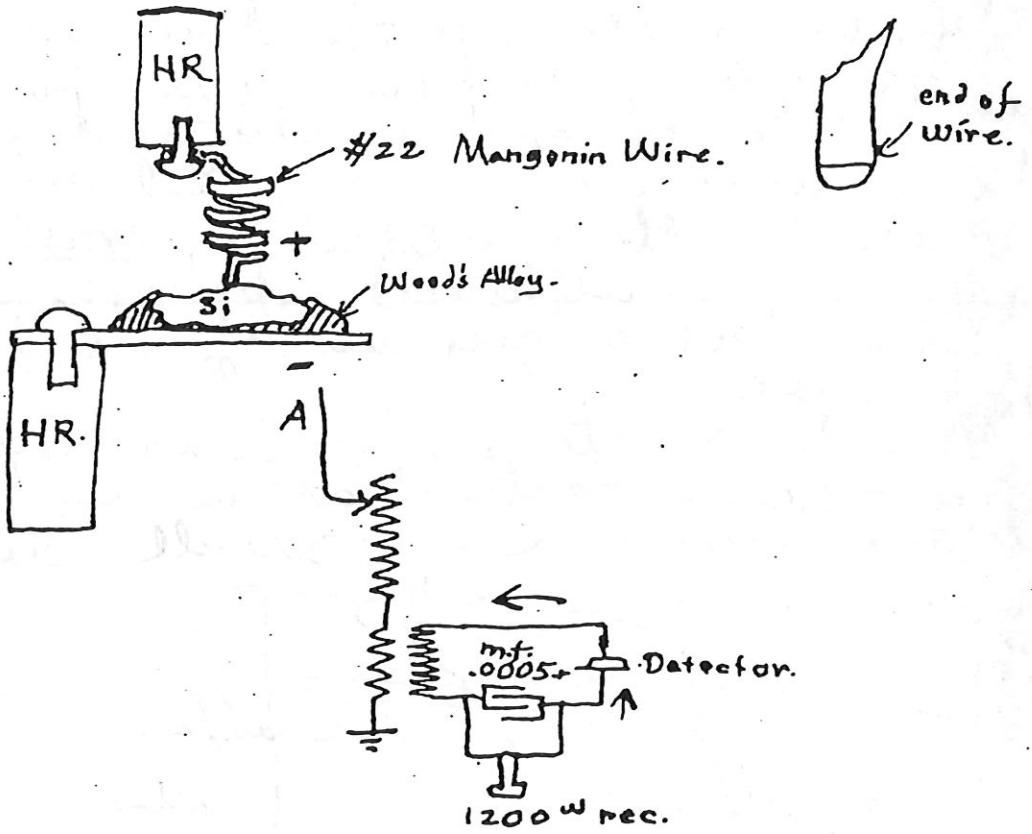
Replacing det. and tel. rec by a resistance
$R = 3960$ ohms

x =	
50	7.5
100	14.8
200	30.0

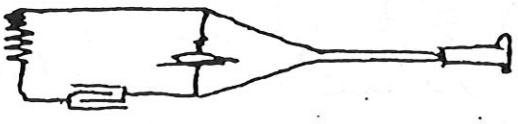
$10 : 15 :: \frac{1}{R} : \frac{1}{3960}$

$R_{det\ circuit} = 5940$ ohms, with a potential

Wireless Telegraphy Aug 21/06
Silicon Detector.
Measurements -



With Wellfleet sending, there seemed to be a slight gain in the above connection, as compared with:



Doublers owing to the capacity of the receiver cords and windings acting as a capacity shunt around the detector.

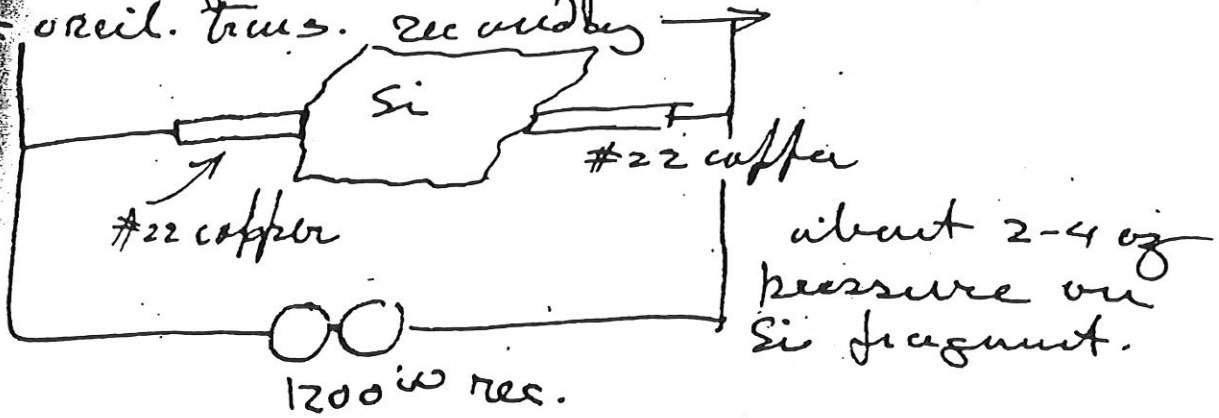
Was unable to detect any gain in this form of detector over the double contact type.

Wireless Telegraphy Aug 15/06

Silicon Detector.

Experimenting with detector of 13-14/06, response was found to suddenly increase as potential of local battery was decreased. Eliminating the local battery altogether, excellent response was obtained, approximately as good as best adjustment of Zn Pt wire KOH cell.

Evidently the response is due to thermo-electric action at a high resistance junction of small dimensions.



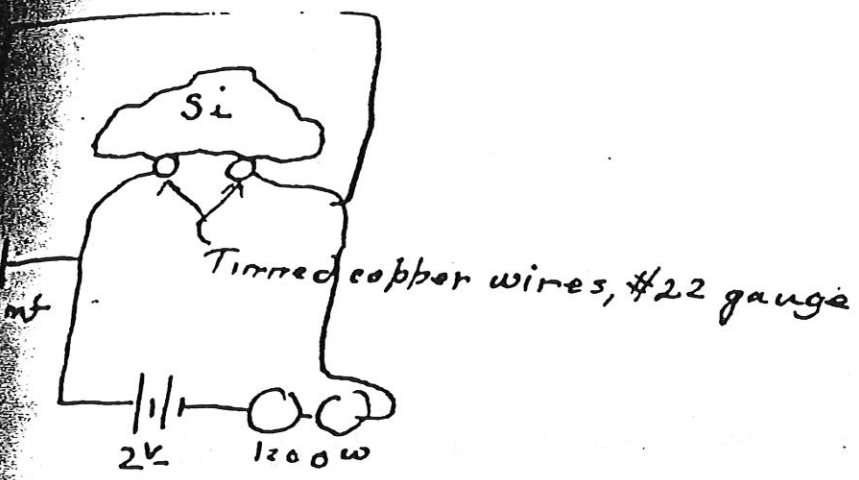
Response could be obtained at almost all points on fragment.

Using 1×10^{-6} amp. 2×10^{-5} b.p.s current, good detection on small W.R. characteristic could be obtained. By making one terminal larger than the other, the current could be reversed at will.

Response excellent against Cu, Cu-Zn, Fe, and Sn terminals. Material seems to make little diff.....

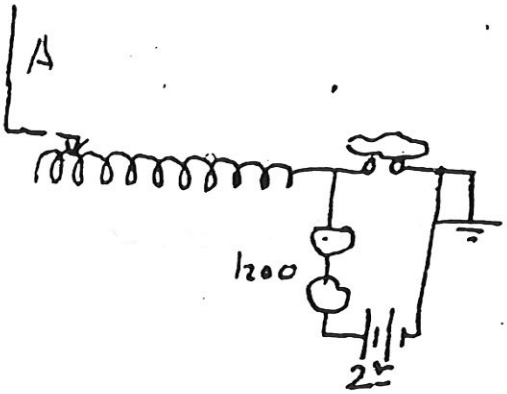
...less Telegraphy
...ium detector

Aug 13/06



...received from Mr Potter. 1.5-gm lump, ...ding by its weight alone on a pair of ...w copper wires, about 0.5-cm apart. ...ls near Wellfleet faintly. The detector ...ed to be of low resistance, as compared ...th a similar carborundum contact.

Aug 14/06



Gave better signals from Wellfleet than with arrangement of the 13th. Electric light induction on antenna was very troublesome, however. As the detector is quite low resistance, this direct inclusion in antenna circuit to earth should be better than in the second as winding of a step-down transformer.

Silicon. Aug 13/06
Sample Received from Mr Patter.
Specific Gravity

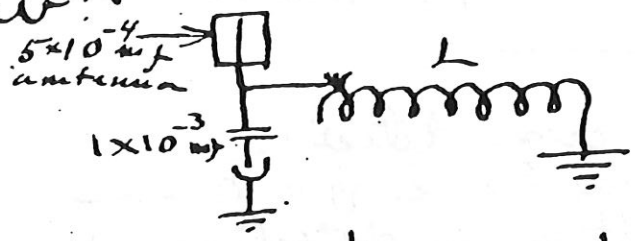
Air	1.4637
Water	0.8500
Wire	0.0184

	1.4637
	.0184
Wt. Si	1.4453
	.8500
Wt H_2O	.5953

S.G. = $1.4453 \div .5953 = 2.43$

Wireless Telegraphy. Aug 1/06.
Tuning Inductances.

Wellfleet requires on circuit below:

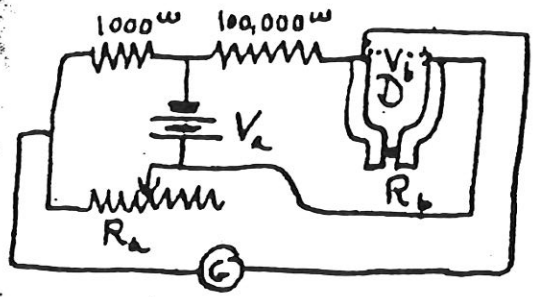


L = .00273 henry for resonance.

An inductance of this value, consisting of 20#36 insulated) stranded wire wound in a single layer on a wooden drum 18cm diam, was substituted for the long helix (singly unplugged - (4.6 cm diam). Although carefully adjusted to exact "tune" the response was not nearly so loud as with the old long helix. As the large drum helix was of lower resistance for the same inductance than the smaller one, it should have given better results. Probably greater capacity between terminals accounts for this.

Anders Telegraphy
Carborundum Detector

June 17/06



D consisted of short copper rods, sprung apart by carborundum fragment placed between

V_b voltage across detector
R_b ohmic resistance of detector
i_b current through detector, micro amps
W_b Watts $\times 10^{-6}$ in detector

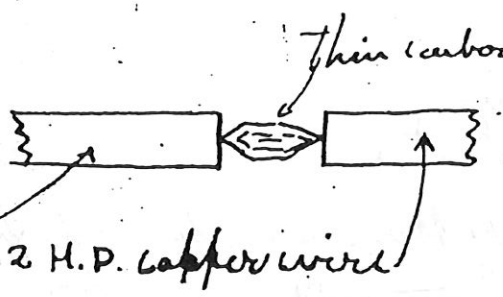
V_b	R_b	i_b	W_b
0.127	4700000	.027	.00343
0.233	3240000	.072	.0168
0.323	2000000	.162	.0525
0.400	1390000	.288	.115
0.466	862000	.540	.250
0.625	574000	.915	.480

The above measurements were made by a direct deflection method. Those following were by bridge as above.

0.575	383000	1.500	.863
0.621	259000	2.40	1.48
0.663	179000	3.70	2.35
0.700	132000	5.30	3.70
(Hand) 0.675	93300	7.20	4.85
0.738	36000	20.6	14.7
0.803	23600	340	27.3
0.854	18900	61.6	52.6
0.940	7200	131.0	123.

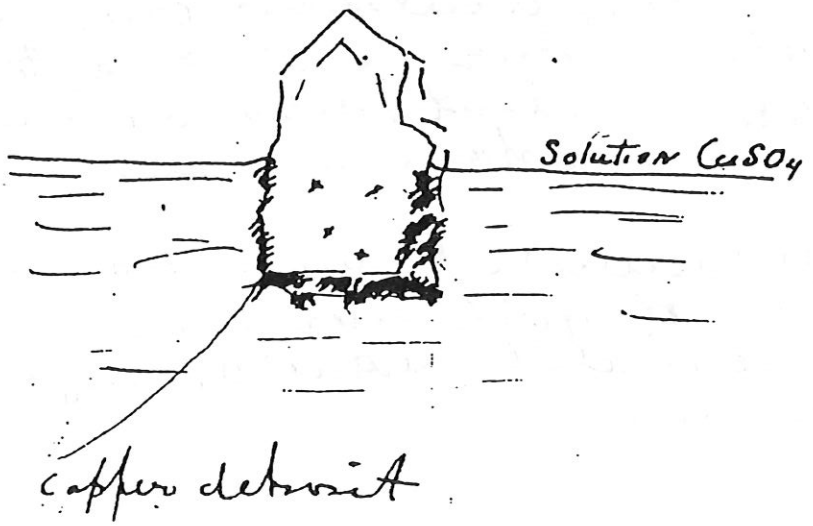
Wireless Telegraphy
Carborundum Detector.

May 13/06



Best results have been with a single crystal, 1-3 m.m long, 0.1-.2 m.m thick, supported between two flat copper faces, which are pressed firmly on the crystal. C.C could be heard faintly with several crystals. E.M.F 2 v.
Four E.M.Fs seemed to give the best results; it worked better on 2 than 3 v. Crystals seem to conduct in perhaps better, contact, only on points and edges; the flat faces are extremely high resisting.

An attempt to copper plate a crystal showed this very clearly; the plated crystal appearing like this:

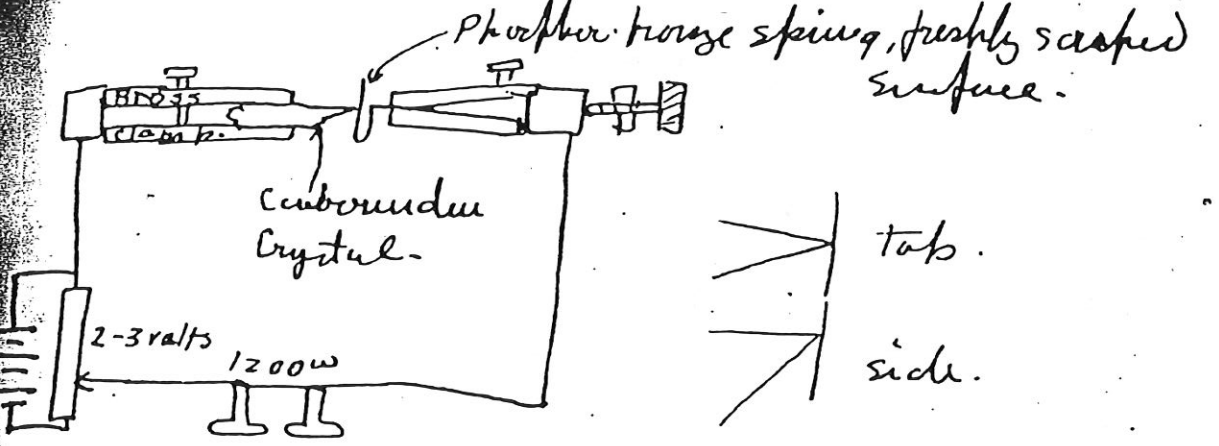


May 14/06

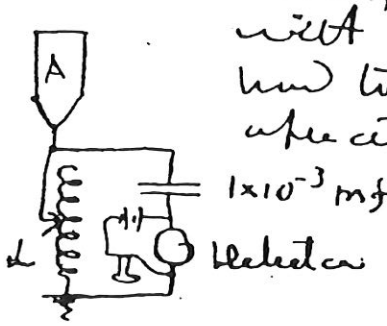
By carefully selecting a crystal with sharp

Wireless Telegraphy -
Carborundum Detector

May 7/06



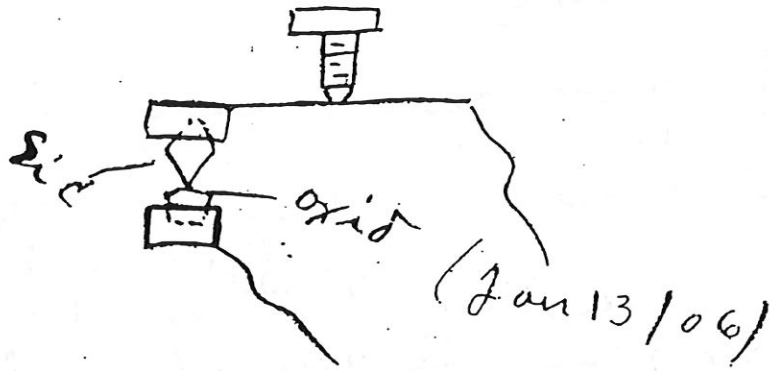
The carborundum crystal was translucent. Saphire blue by transmitted light, with a green metallic reflection. Extremely sensitive to 2×10^{-5} p.p.s., giving loud response to 10^{-8} amps or less. Was unable, however, to hear C.C. on this circuit, which gave loud return with E. detector. Probably a too low resistance. When operating, oscillations cause a decrease in resistance, about 10-20% when resistance is loud.



Resistance, measured at 200 ω 1000-2000 ohms, and appears quite asymmetric, as no sharp balance could be obtained, only an ill defined minimum.

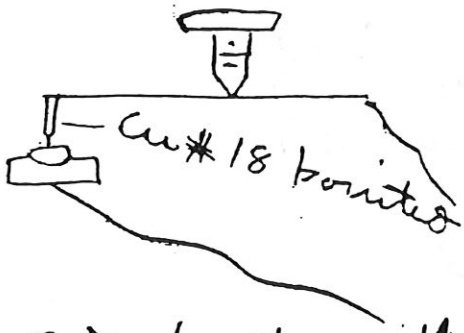
Wireless Telegraphy May 7/06

Arc coats - Carborundum



(Jan 13/06)

Ti, Fe, Zn, & Cd not so good as metal with Si C.



Zn & Cd best with no. battery but Fe gave 15% increase with 6/10 volt; Ti 20% with 1.1 volt.

Oerlikon Telegraphy. April 22/06
Capacity Amesbury Aud.

Mean of 4 measurements, using air cond. sections of 1040 m.m.f. and 2008 m.m.f. gave 458 m.m.f. as the capacity.

With C.C. reading, 4, 1, 2, and 3×10^3 m.m.f. (50 m.m.f.) (+C) (+C) sections were placed in shunt to antenna and earth. Resonant with λ = 18.7, 15.0, 6.3, 4.0, 2.8 resp. in arbitrary units

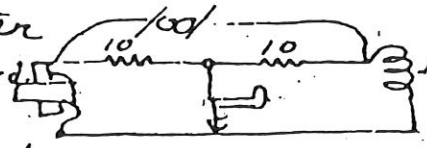
$$\begin{aligned} 2.8 &(A + 3\times10^3 + C) \\ = 4.0 &(A + 2\times10^3 + C) \\ = 6.3 &(A + 1\times10^3 + C) \\ = 15.0 &(A + C) \\ = 18.7 &(A + 50) \end{aligned}$$

Wireless Telegraphy April 22/06
Capacity Measurements Antenna

Mean of 4 measurements at 200∼ against air condensers of 1040 m.m.f. and 2008 m.m.f. gave for capacity 458 m.m.f. This antenna is a single loop of #12 copper wire, about 40' high.

Feb 22/06

Duplex Inductometer

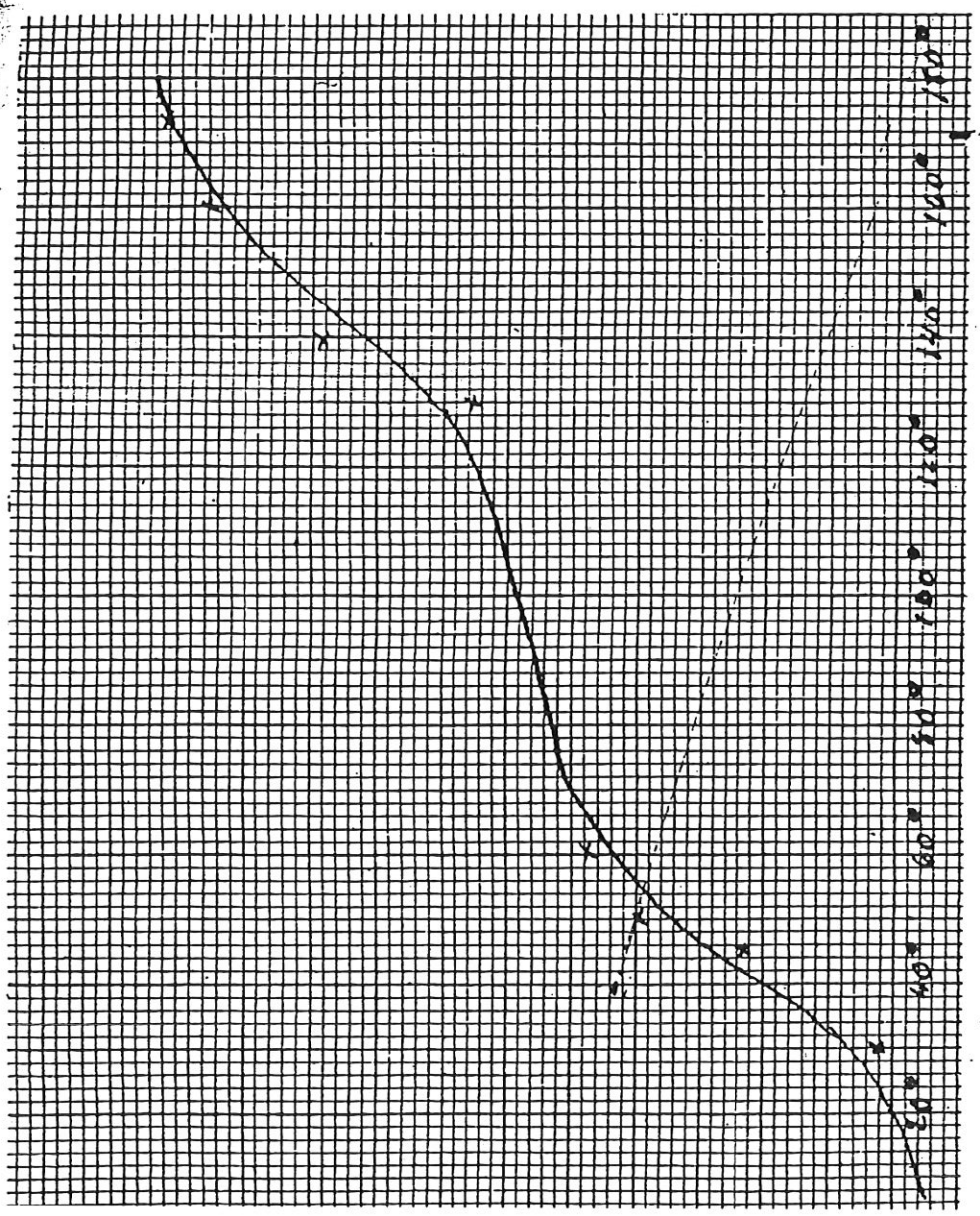


130 ~ a.c.

Minimum position = 0°

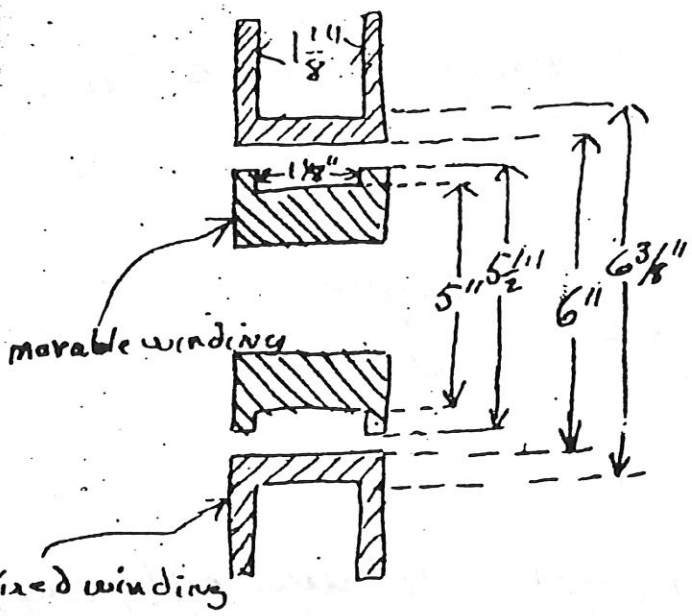
30° = 0.43 m.h.
45° = 0.63 "
60° = 0.79
60° = 0.87
130° = 1.05
140° = 1.29
160° = 1.45
175° = 1.52

It is to be noted that the calibrating inductances were simply long helices, where inductance was approx. computed from $L = \frac{4\pi^2 r^2 N^2}{l}$ and that the angles of the inductometer were estimated by eyes or scale being attached.

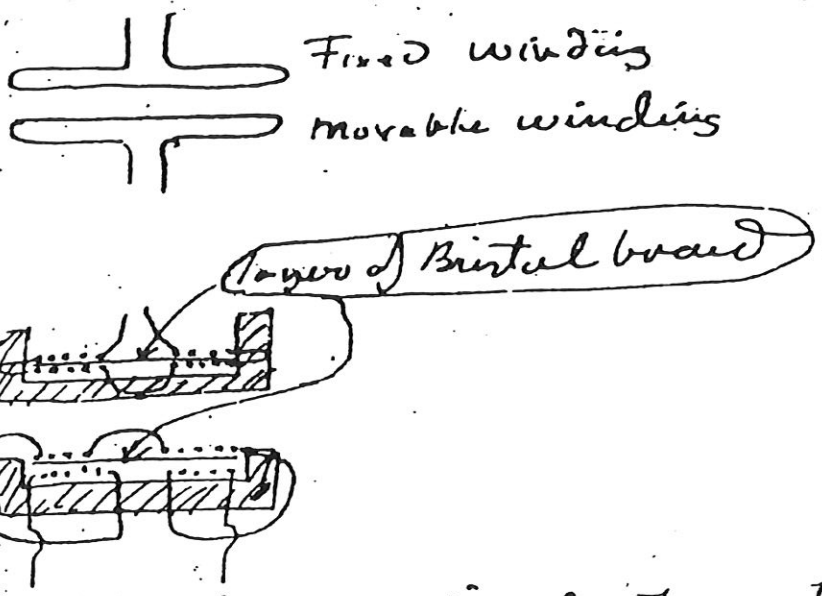


Feb 22/06

Wireless Telegraphy
Ring Inductometer

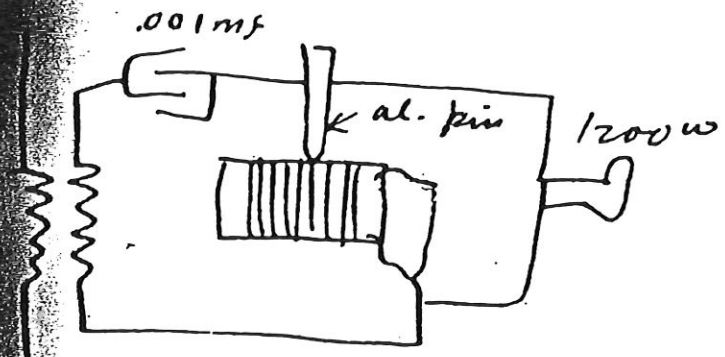


Each spool was wound with 40 turns # 22 d.s.c. copper wire. Connected in series, the resistance (steady current) was 2.0 ohms.



Maximum inductance, estimated from turns with C.C. 1.4 millihenrys.
Minimum values about 1/3 of maximum.

Wireless Telegraphy Feb 4/06
Mercury detector.



Low resistance, (600 ω) telephone coil, enclosed in pipestone cylinder. Thin layer of ammonium &c. A number of points found that gave fair response to CC.

Wireless Telegraphy. Feb 2/06
Thermo-Electric Detectors.
Arc" coats of Jan 13, 1906.

Against 2 μ Electrolytic = 100

	500 w	1800 w
Ti	35	50
Zn	30	55
Fe	40	20
Cd	10	5

Evidently efficiency increases with higher wound phones.

Wireless Telegraphy. Jan 21/06
Bismuth - Antimony Couple.

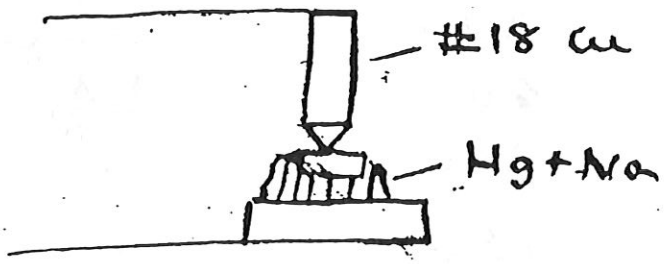
To make contact high resistance, a layer of sulphide was found on Bi.

With some adjustments, that could not be called for large C.C. flow clearly. Battery in circuit seemed to decrease intensity of resistance.

...less Telegraphy Jan 13/06
...uso-Electric Detectors
...c" Coats

...ats of the 12th were scraped off, mixed with 10% borax, and fused for 3 min in 11 amp arc. On C.C.

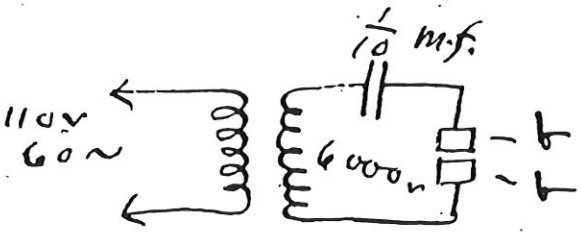
Oxid	Chmnt.	
Fe	35	easy
Zn	35	"
Cd	80	"
Cu	1000	dif
Pt	80	easy
Ti	50	"
Sn	∝	N.D.
Ni	1000?	v. dif.



Apparently the borax under test no effect other than to consolidate oxid. Effect of re-fusing was to make oxids several times

Wireless Telegraphy
Thermo-Electric Detectors
"Arc" Coats

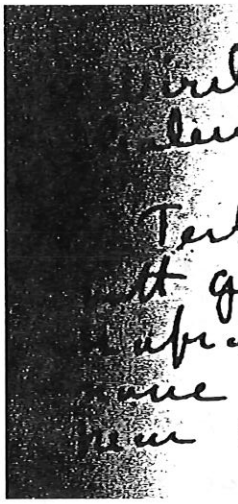
Jan 12/06



Very heavy arc-like discharge passed between b-b for 30 min, resulting in the formation of heavy, semi-fused oxid coats or layers on the blocks

Tested as detectors on CC and Brant Rock

	Shunt ohms	Adj
Fe_3O_4	180	Easy
ZnO	155	"
CoO	180	dif
MnO_2	200	Easy
Cu_2O (?)	600	dif
PbO(?)	200	"
TiO_2	150	"
Sn (?)	1000	"
Ni (?)	800	V. "



Jan 7/06

Telegraphy
Galena - Pyrite det.

Tests of Lagen ores of fragments
of galena and pyrite. All found to
be pyritic or Iron-dextrin det. but
some comparable with detonation. Unable to
find C.C. on account of thin samples.

Telegraphy. " Jan 3/06
- Pyrite detector.
Silicon and Pyrite fragments of the
Tested with range E.M.F in circuit.

20 volts. After long adjustment, refused for about 10 s, then suddenly came

10 volt After long adjustment, fair response 10^{-7} amp. Loud off in 1-2 minutes, tried 5 min to find points again.

02 volt Fairly regular action, but difficult to find best point.

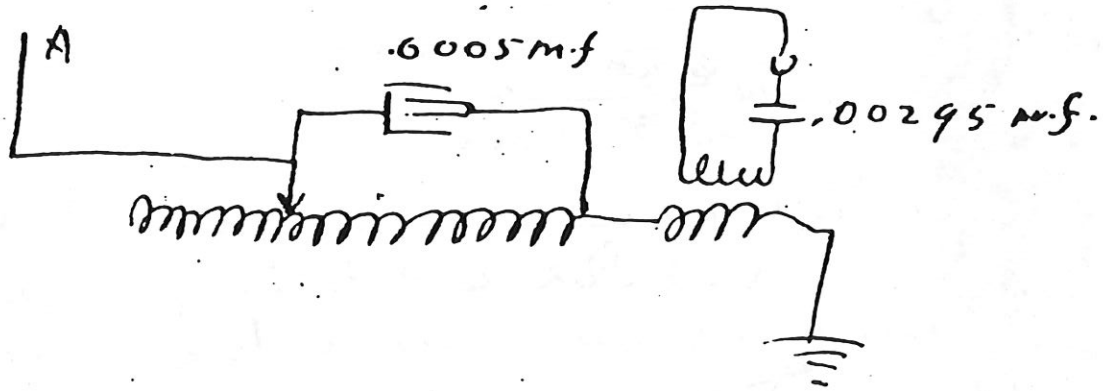
00 volt Response 10^{-9} amp, R.M.S. value! Worked well for some half

Ground galena surface // to charge in E.C lines. Obtained a fair point in way - Making contact with this surface Pyrite point, but best result got.

about 1 v.d = 10^{-8} amps
20° = 9×10^{-12} amps
eff. 1 in 25-00 ?

Amerbury
Dec 19/05

Wireless Telegraphy.
Receiving Circuit.

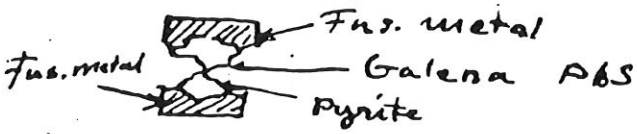


Brant Rock & Wellfleet simultaneously reading.

This circuit enable me to adjust Wellfleet time Brant Rock set, leaving C.C. load as before.

Dec 12/05.

...mon electric detectors.
...lena - Pyrite.



...from high resistance and thus...detector ...ers of metallic sulphides, it would ...e that above combination should ...ve good results.

Tests made this evening, on 1×10^{-9} - $\times10^{-6}$ amp. at 500,000 ohms. showed ...iderable sensitiveness, but difficult adjustment. All contact points on pyrite were not at ...matic; two were all on the galena.

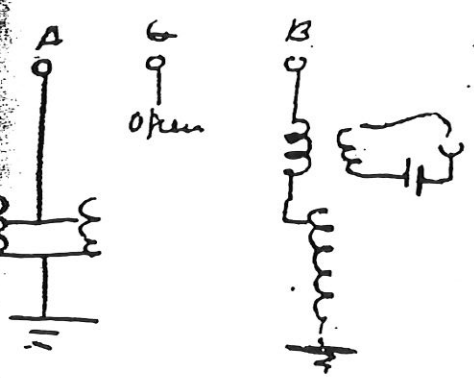
Oct 8/05.

less Telegraphy.
tors.
here are at least two lines
which commercial detectors may be
built, and which do not involve
delay, or "trigger" action.
a Rectifier detectors
1 Vacuum Tube
2 Electrolytic cells
b Thermo-couples.

e made current flow, and retaining both
n.F of vacuum tube rectifiers is a decided
l temperature, and electrolytic material must
into this.
electrolytic rectifiers, such as the Dubois, are
doubtless practical, but would require any
power of voltage, and, for this reason, would
e merits of Fessenden (?)
Thermo-couples can be made of sufficient
sensitiveness for commercial work, and probably
stable enough. An occasional adjustment for
new contact surface would be unobjectionable.
Paper material will probably eliminate this.
Silver for one contact element would insure stability
oxidation of other would keep area constant.

Sept 28/05
Scuttle Boston.

Timing Circuit



With this condition, Fessenden could be tuned two out, having Wolffleton tuned on 0. Reverse of this next time. Fessenden must have a much more violent oscillation than Wolfleton